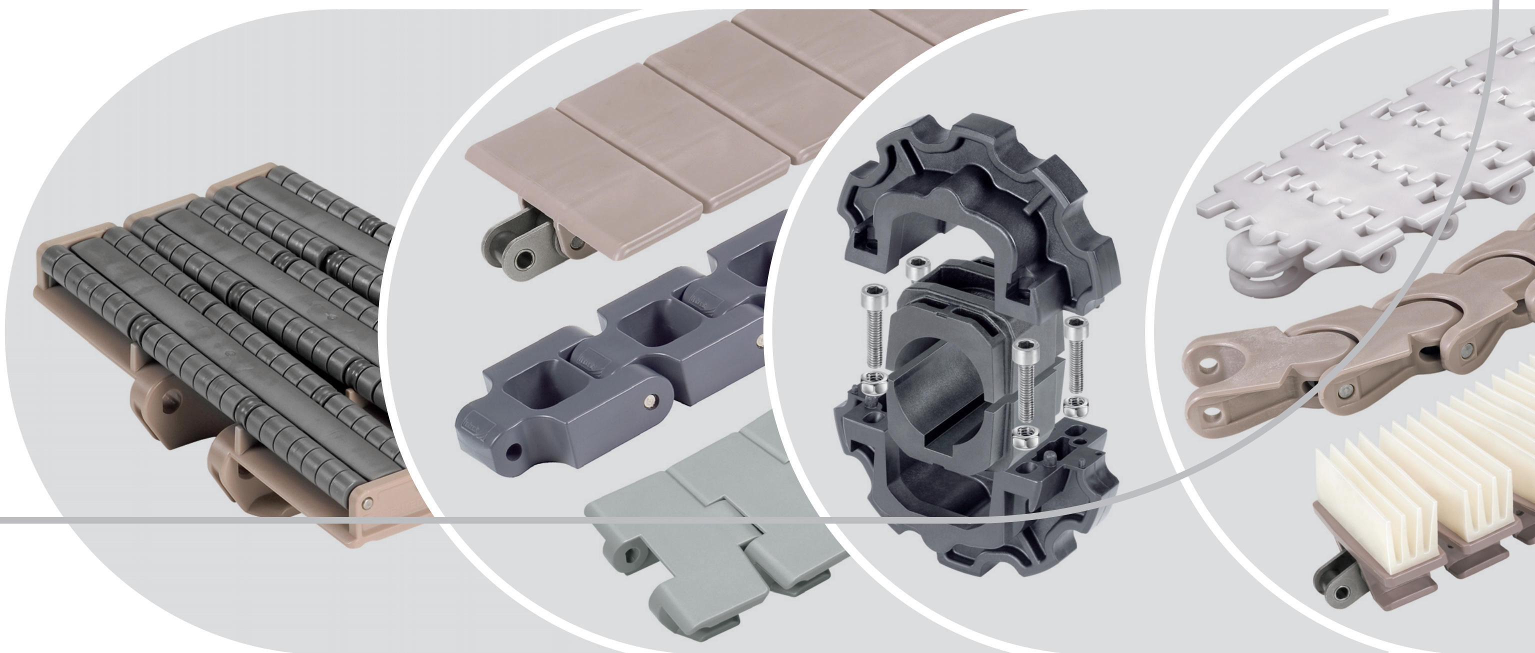
Services
Media No. 6017

HabaCHAIN®
Slat and Conveyor Chains

Engineering Guide

Habasit – Solutions in motion



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Warning

Habasit belts and chains are made of various plastics that WILL BURN if exposed to sparks, incendiaries, open flame or excessive heat. NEVER expose plastic belts and chains to a potential source of ignition. Flames resulting from burning plastics may emit TOXIC SMOKE and gasses as well as cause SERIOUS INJURIES and PROPERTY DAMAGE

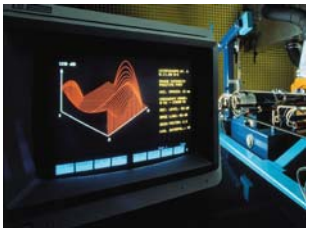
Contents

The Habasit solution

At Habasit, we listen to our customers, innovate continuously and deliver reliable solutions to meet your every need.

Customers come first
At Habasit we understand that our success depends on your success. This is why we offer solutions, not just products; partnership, not just sales.
Since our foundation in 1946, Habasit has brought this understanding of customer needs to life every day and for every application. That's why we're the No. 1 in belting today. Worldwide.


Committed to innovation
Habasit is strongly committed to the continuous development of innovative, value-added solutions. Over 3% of our staff are dedicated exclusively to R&D, and our annual investment in this area exceeds 8% of turnover.




Certified for quality
We deliver the highest quality standards not only in our products and solutions, but also in our employees' daily work processes. Habasit AG is certifie according to ISO 9001:2000.

Worldwide leading product range
Habasit offers the largest selection of belting, conveying, processing and complementary products in the industry. Our response to any request is nothing less than a specific, tailor-made solution.

A selection of our product ranges:

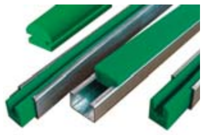
HabaFLOW®
Fabric based conveyor and processing belts

HabasitLINK® & KVP®
Plastic modular belts

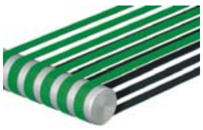
HabaDRIVE®
Power transmission belts

HabaSYNC®
Timing belts

HabaCHAIN®
Chains (slat and conveyor chains)



HabiPLAST®
Profiles, guides wear strips



Machine tapes

Seamless belts

Round belts

Fabrication tools (joining tools)

Gear reducers, gearmotors, motion control

Electric motors

Worldwide support
Our extensive organization is ready to support you anywhere in the world. Engineering and emergency assistance, quotes and order status are just a phone call away. Wherever you are. Whenever you need us.

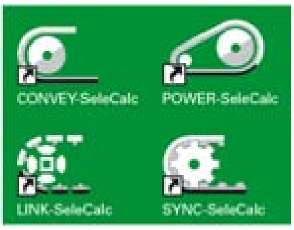
For additional information please visit:
www.habasit.com

Services

Comprehensive services are central to Habasit's belting solution approach.

As committed partners to our customers, we are dedicated to sharing our knowledge and to providing full support.

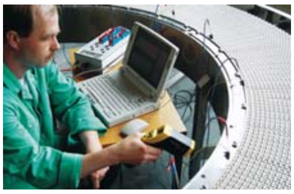
Comprehensive consulting and technical support
Habasit offers the best consulting and technical support on the belting market. Everything revolves around our customers. Each affiliate has its own belting experts. The Habasit team proudly provides the highest levels of support and top quality products enjoyed by the global market for over 60 years.



Assistance with belt selection and calculation
We will select and calculate the most suitable belt for your specific application. You also may do this yourself with our state-of-the-art Habasit selection and calculation program "SeleCalc". To order this program free of charge, simply call your nearest Habasit partner or contact: info@habasit.com.

Fabrication, assembly and local installation services for quick reaction times
We make belts endless or assemble modular belts or chains, either at our own locations or on-site directly on your machine or system. Habasit operates 33 affiliated companies worldwide, each with its own inventory, fabrication, assembly and service facilities. Together with our representative offices and numerous qualified distributors,
we can react quickly, competently and reliably to satisfy all your demands.

Customer training programs
Habasit offers training programs and provides support tools to ensure optimal use of our products and to prolong their lifecycles. Training on fabrication, installation, assembly, maintenance and belt repair takes place at Habasit sites or at your location.



Belt monitoring, inspections, analyses and process optimization proposals
We organize and handle belt maintenance, inspections, analyses and surveys for your
locations. On request we will also work with you to develop optimization proposals, e.g. to achieve added value from the machinery or process output.

Design assistance for customized solutions
Habasit believes in partnership. Our engineering team will work closely with your engineers on joint design developments, preferably from a very early stage. We particularly recommend this for projects involving new technologies or large-scale modifications and adaptations.

Introduction
The features of HabaCHAIN®

Wide product range meeting industry requirements

The HabaCHAIN® range from Habasit provides optimum solution and wide choice to meet most of industrial conveying requirements, thanks to the wide range comprising of Slat Top Plastic and Steel, Low Back Pressure (LBP), Flexi, Snap-on, Multiflex and Case Chains.

State-of-the-art materials

Habasit understands the industry's requirements for a complete range of innovative and state-of-the art materials and therefore HabaCHAIN® range of chains is offered in a multitude of materials ranging from standard as well as low friction POM (Acetal) DP & LF to customized materials like extra low friction TS & NG; electrically conductive EC; extra wear resistant PK, WR & WK along with a host of other specially formulated compounds. This wide choice enables our customers to choose the most optimum solution meeting their application requirements in best possible manner.

Multi-Hub sprockets and idlers

Habasit has invented a new type of modular split sprockets and idlers called Multi-Hub. Interchangeable hub inserts in various diameters with or without keyway and sprocket, or idler rims in two different materials reduce the inventory needed by our customers. With this innovative Multi-Hub system it is possible to combine a noise dampening sprocket rim with a stiff and wear resistant hub. The customized choice of materials and high fabrication accuracy ensure long lifetime as well as optimized power transmission.

Flexi C7100 chains with patented retaining system

To serve the needs of packaging industry, Habasit has developed a state-of-the-art patented retention system for Flexi chains which makes it simple to disassemble and join the chains with only a screwdriver.

Low Back Pressure (LBP) chains

In order to provide a solution for accumulation applications in packaging and material handling industries, Habasit has introduced a series of chains with patented low back pressure rollers installation concept. This concept enables easy replacement or cleaning of rollers if required as well as an option to use sliding blocks in between rollers as a cost efficient measure.

HabiPLAST® extruded profiles and wear strips

Complementing the HabaCHAIN® product range, Habasit offers an enormous range of HabiPLAST® extruded profiles, guides and wear strips, manufactured in a highly modern plant with proprietary technology. This range of products offers great wear resistance, low coefficient of friction, low noise, good impact resistance, high chemical & corrosion resistance as well as easy assembly along with possibility to offer customized solutions.

Introduction
Product range – information

Product information on www.habachain.com
Please visit our website for in-depth information on products and applications as well as for detailed technical data.

Product information in brochures
HabaCHAIN® Slat and Conveyor Chains are produced to the highest standards. The range comprises more than 65 chain types, with new types constantly under development to always ensure the most advanced offer. For detailed product information about our chains refer to the brochures “4122 HabaCHAIN® Product Overview” and “4185 HabaCHAIN® Product Guide”.

Introduction
Product range – overview Slat Top Plastic Chains

Straight

4.0 mm


Slat Top 820

4.8 mm standard duty


Slat Top 831

Radius **4.0 mm**


Slat Top 770T


Slat Top 880T


Slat Top 890T


Slat Top 880B


Slat Top 880J


Slat Top 880M

4.8 mm standard duty


Slat Top 879T

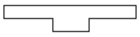

Slat Top 879B

Introduction
Product range – overview Slat Top Plastic Chains

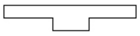
Straight	**4.8 mm heavy duty**  Slat Top 821	
Radius	**4.8 mm heavy duty**  Slat Top 882T  Slat Top 882TG  Slat Top 882B	**8.7 mm**  Slat Top 1061T  Slat Top 1061M

Introduction
Product range – overview LBP (Low Back Pressure) Chains

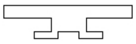
LBP 821 (Straight)



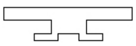
LBP 821 SB (Straight)

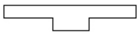
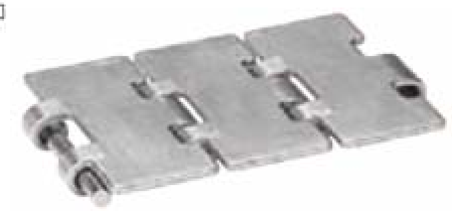
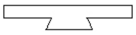
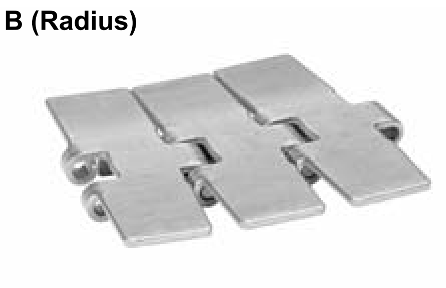


LBP 882T (Radius)



LBP 882T SB (Radius)



Slat Top 800 (Straight)  	**Slat Top 810 (Straight)**  
Slat Top 881B (Radius)  	**Slat Top 881T (Radius)**  

The HabaCHAIN® coding for straight running Slat Top Steel Chains is

for heavy duty, double hinge
C0800 series in CS = carbon steel, SS = ferritic stainless steel, SA = austenitic stainless steel

for standard duty, single hinge
C0810 series in CS = carbon steel, SS = ferritic stainless steel, SA = austenitic stainless steel

Introduction
Product range – overview Flexi Chains

Flexi 7100L

Flexi 7100K

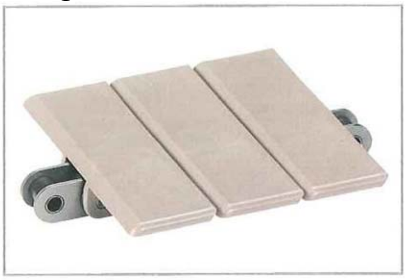
Flexi 7100F

Flexi 7100G

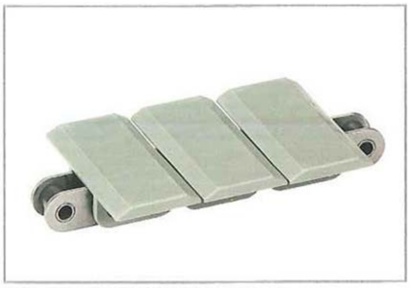
Multiflex 1700	
Multiflex 1701T	

Introduction
Product range – overview Snap-on Chains

Straight **½” base chain**



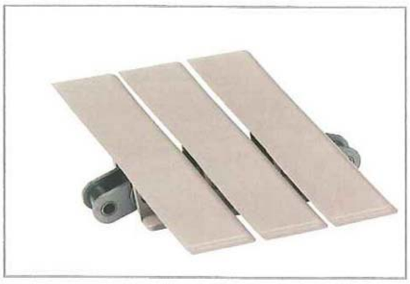
Snap-on 843 (Straight)



Snap-on 843C (Straight)

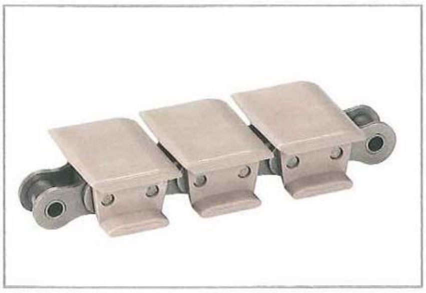
Straight **¾” base chain**

Snap-on 863 (Straight)



Snap-on 863T (Straight)

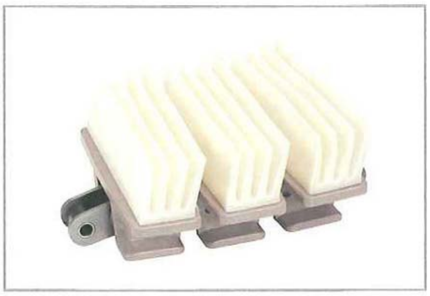
Radius **½” base chain**



Snap-on 1843T (Radius)

Radius **¾” base chain**

Snap-on 1873T (Radius)

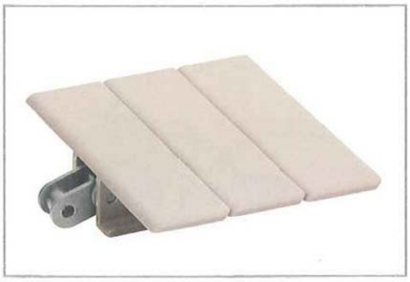


Snap-on 1873+L4 (Radius)

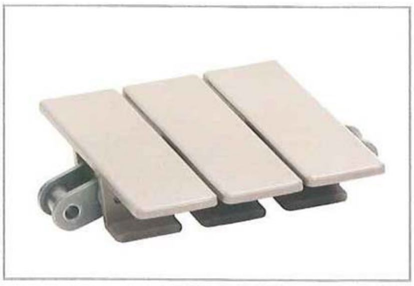
Introduction
Product range – overview Snap-on Chains

Straight **¾" base chain**

Snap-on 963 (Straight)



Snap-on 963T (Straight)



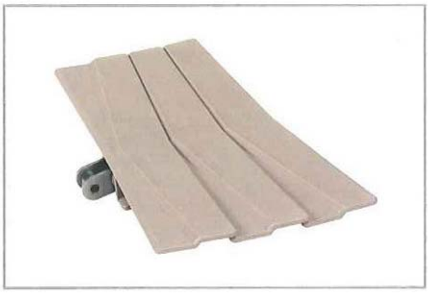
Snap-on 1873T+T (Straight)

Radius **¾" base chain**

Snap-on 1873+D1 (Radius)

Snap-on 2873SD (Radius)

Snap-on 1874T (Radius)



Snap-on 3873T (Radius)

Introduction
Product range – overview Case Chains

Straight ***0.5”***

Case Chain 40P (Straight)

1.0”

Case Chain 80P (Straight)

1.5”

Case Chain 1150 (Straight)

0.75”

Case Chain 60P (Straight)

Case Chain 1100 (Straight)

2.0”

Case Chain 1200 + 3200 (Straight)

Radius ***1.0”***

Case Chain 1110T (Radius)

1.5”

Case Chain 1151T (Radius)

2.0”

Case Chain 1210T + 3210T (Radius)

Introduction
Product range – overview Case Chains

Straight *2.5”*

Case Chain 1250 (Straight)

2.61”

Case Chain NH78 (Straight)

Radius *2.5”*

Case Chain 1251T (Radius)

Case Chain 610T (Radius)

Case Chain 600 (Radius)

Case Chain 611T (Radius)

Case Chain 601 (Radius)

Case Chain 611TE (Radius)

3.25”

Case Chain 1400 (Radius)

Case Chain 1400T (Radius)

Introduction
Product range – overview Multi-Hub Sprockets

Multi-Hub 820 Sprocket-Rim	
Multi-Hub 820 Idler-Rim	
Multi-Hub 821 Sprocket-Rim	
Multi-Hub 880 Sprocket-Rim	

Introduction
Product range – overview Multi-Hub Sprockets

Multi-Hub 881 Sprocket-Rim

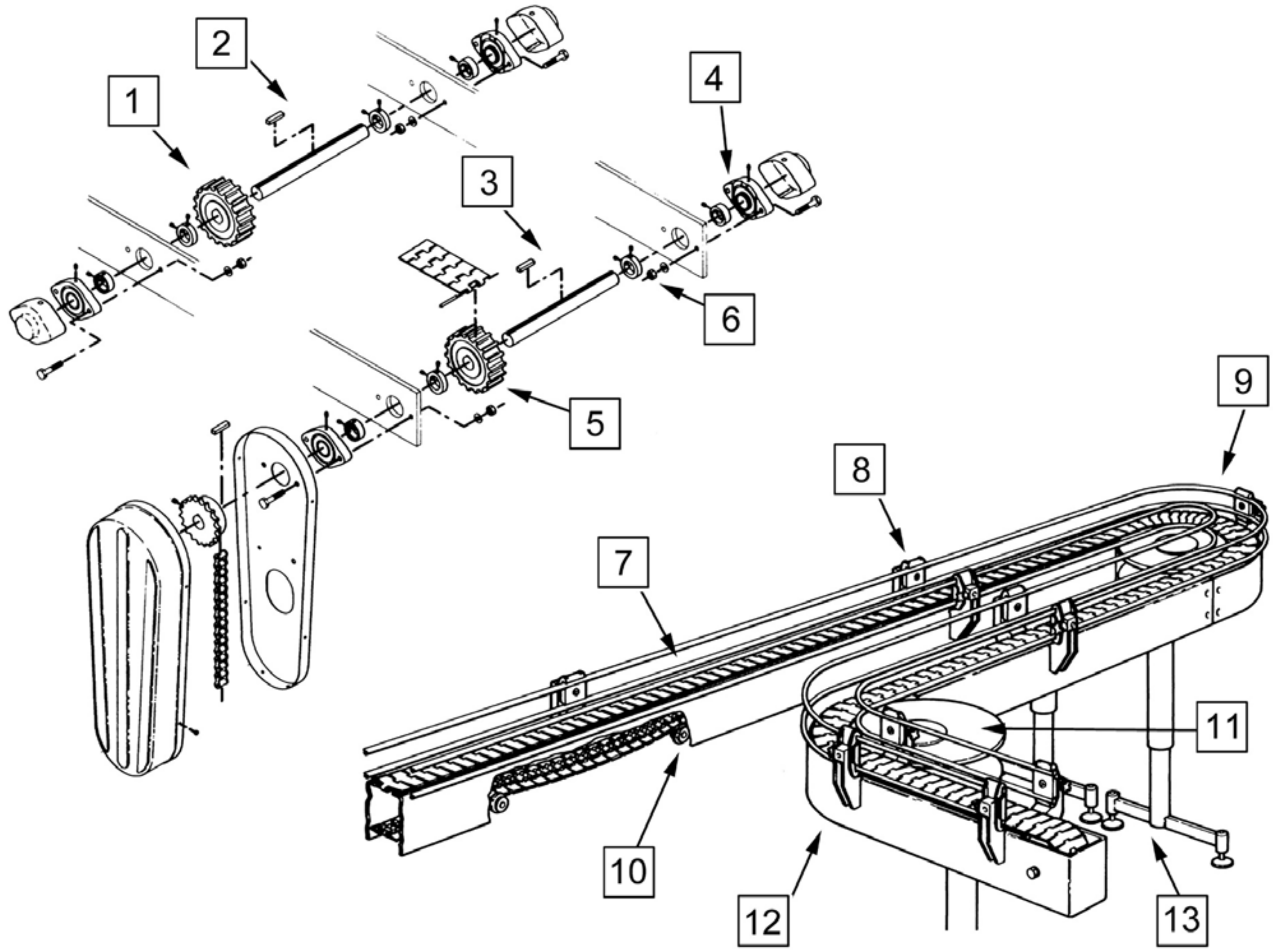
Multi-Hub 882 Sprocket-Rim

Multi-Hub 1060 Sprocket-Rim

Multi-Hub - Inserts

Introduction
HabaCHAIN® conveyor components

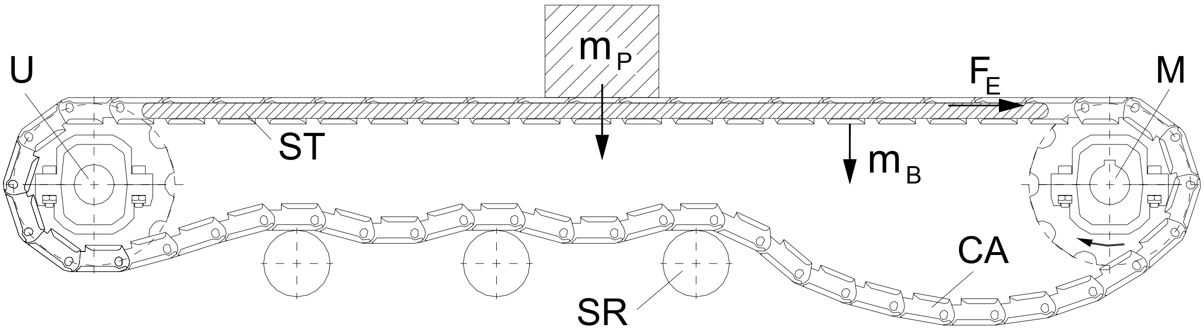
A typical chain conveyor consists of the below shown components.



1 Idler
2 Idling shaft
3 Drive shaft
4 Flange bearing
5 Drive sprocket
6 Retainer ring
7 Wear strip
8 Rail
9 Curve
10 Return rollers
11 Disc wheel
12 Conveyor frame
13 Conveyor foot

Make sure the conveyor is leveled. Wear strips, rollers and chains will wear unevenly if the conveyor does not stand horizontal.

Introduction
HabaCHAIN® conveyor components



M **Driving shafts** for chain conveyors are usually round with keyway. For keyway dimensions see chapter “Design Guide - Shaft and keyway dimension”.

U **Idling shafts** (round without keyway) can be equipped with sprockets or idlers.

ST **Wear strips on the transport side** carry the moving chain and load.

SR **Chain support on the return side** can be equipped with rollers or longitudinal wear strips (slider support).

CA **Catenary sag** is an unsupported length of the chain for absorbing chain length variations due to thermal expansion, load changes, chain wear and chain tension.

F_E **Effective tensile force (chain pull)** is calculated near the driving sprocket, where it reaches its maximum value during operation. It depends on the friction forces between chain and support (ST) (SR) as well as on friction against accumulated load.

m_P **Conveyed product mass (weight)** calculated in N *(lbf).*

m_B **Chain mass (weight)** is added to the product mass for calculation of the friction force between chain and support.

Introduction
Chain and sprocket evaluation

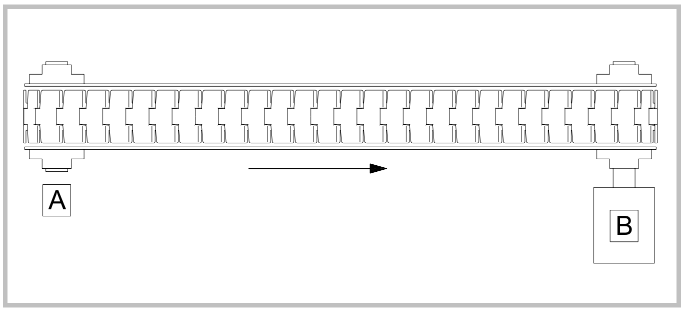
Evaluate the - desired chain type	Refer to the HabaCHAIN® Product Data Sheets either on the HabaCHAIN® website (www.habachain.com) or in the HabaCHAIN® Product Guide
- corresponding sprocket type	Refer to the “Sprocket cross-reference” below or to the HabaCHAIN® Product Data Sheets
- suitable chain material	Refer to the Material Overview in the HabaCHAIN® Product Guide and the Product Data Sheets
- suitable wear strip material	Refer to the HabiPLAST® Product Guide (you can download from the HabaCHAIN® website (www.habachain.com))
- design concept	Refer to the chapter “Design Guide” of this HabaCHAIN® Engineering Guide and draft the layout of your equipment
Calculate the chain tensile force, power requirements and shaft sizes	Refer to the chapter “Calculation Guide” of this HabaCHAIN® Engineering Guide. Verify the selected chain comparing with values from the HabaCHAIN® Product Data Sheet
Establish the size of sprockets	Refer to the relevant HabaCHAIN® Product Data Sheet

Sprocket cross-reference

Sprocket type	Chain type
Multi-Hub 820 Sprocket-Rims	810, 820, 831
Multi-Hub 820 Idler-Rims	810, 820, 831, 879B, 880B, 881B
Multi-Hub 821 Sprocket-Rims	800, 821
Multi-Hub 880 Sprocket-Rims	879, 880, 890
Multi-Hub 881 Sprocket-Rims	881
Multi-Hub 882 Sprocket-Rims	882
Multi-Hub 1060 Sprocket-Rims	770, 1061
Solid Sprockets – Series 600	600, 601, 610T, 611T, 611TE
Solid Sprockets – Series 810	810
Solid Idlers – Series 810	810, 820, 831, 879B, 880B, 881B
Solid Sprockets – Series 820	810, 820, 831
Solid Sprockets – Series 821	800, 821
Solid Sprockets – Series 880	879, 880, 890
Solid Sprockets – Series 881	881
Solid Sprockets – Series 882	882
Solid Sprockets – Series 1100	1100
Solid Sprockets – Series 1150	1150
Solid Sprockets – Series 1200	1200, 3200
Solid Sprockets – Series 1250	1250
Solid Sprockets – Series 1400	1400
Solid Sprockets – Series 1700	1700
Solid Sprockets – Series 3200	3200, 1200
Solid Sprockets – Series 7100	7100
Solid Idlers – Series 7100	7100
Solid Sprockets – Series NH78	NH78

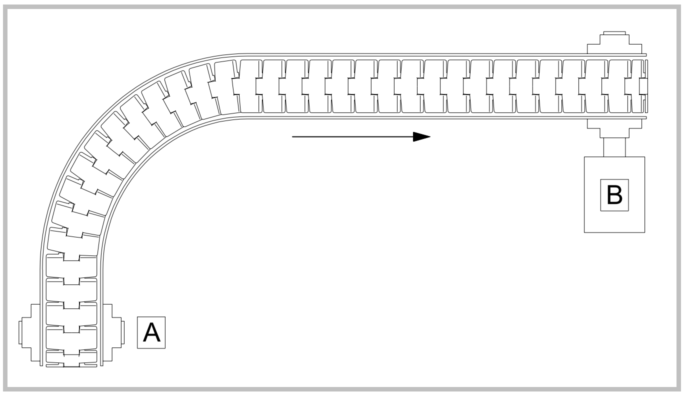
Design guide
Horizontal conveyors – basic design

Straight-running configuration
A straight conveyor with a single drive is the simplest and most ideal design. Often several short conveyors are required due to application constraints. This is more expensive because of the additional shafts, sprockets and drive motors required.



Radius configuration
When planning a radius conveyor layout, the designer should consider the following factors that affect chain life:

- When conveying from Point A to Point B, design the conveyor so that the curve is positioned as near to the idling shaft (A) as possible. This results in lower chain tension and improves chain life.
- Minimize the number of curves and the angle of each radius whenever possible.

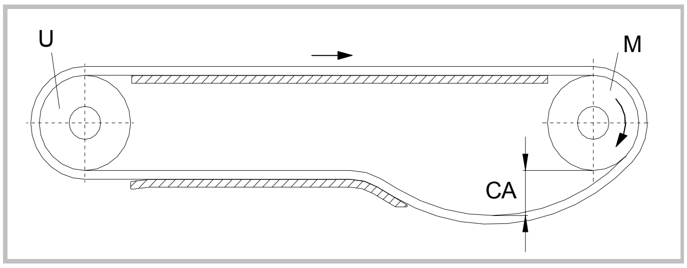


When conveying products around a curve with an angle of 90°, a single chain conveyor with a radius chain offers the following advantages over two separate straight conveyors that have transfer plates between them:

- Eliminates dead plate transfers (or turntables), preventing the product from slipping or stalling
- Minimizes tipping and jamming
- Decreases noise
- Reduces the cost of controls and maintenance by only requiring one drive motor

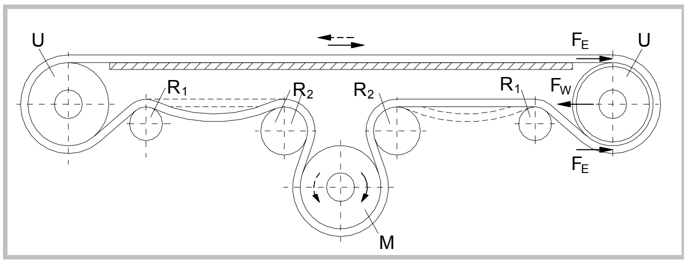
Drive and tensioner construction

Uni-directional head drive
One drive motor (M) at conveyor end, pull action.
Catenary sag (CA) only required on drive end.



Bi-directional center drive (omega drive)
One drive motor (M) placed somewhere in the middle of the chain return. Pull action.
Since the driving force is applied on the return way of the chain, the shaft load F_W will be two times the calculated chain pull:

$F_W = 2 \cdot F_E$ [N/m], *[lbf/ft]*



Note: Center drive does not apply to all chain types

Conveyor length

Maximum length of conveyor
Several factors are influencing the possible conveyor length:

- Conveyor configuration
- Chain type
- Coefficient of friction
- Load
- Speed

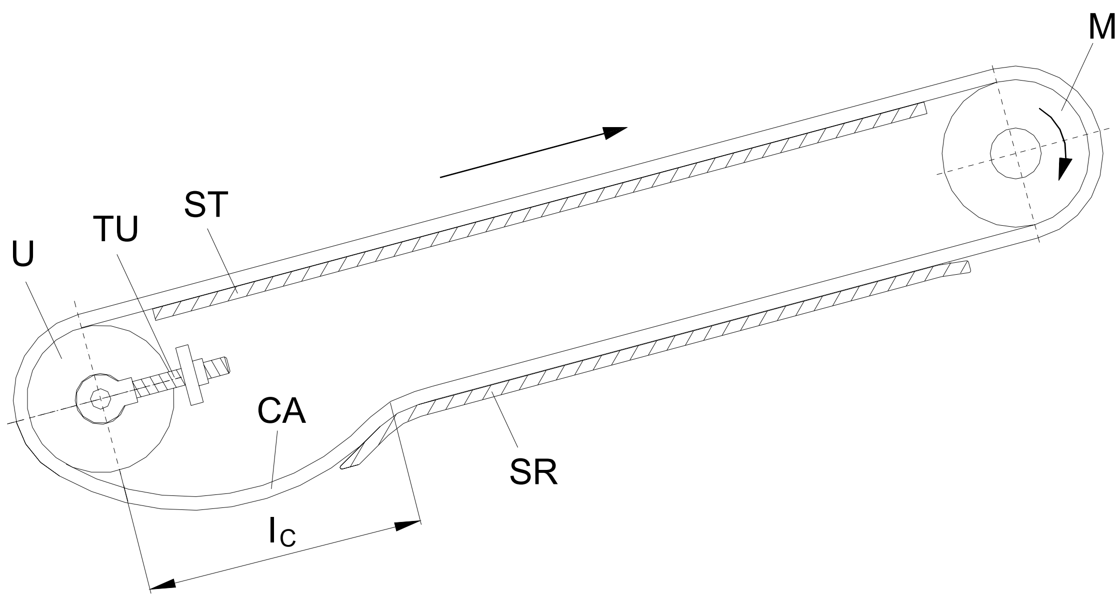
In normal practice track lengths should not exceed 20 m (*66 ft*) center to center.
It is important to consider that wear is depending on the environment, the load, the speed and the time applied.
Due to the limited stiffness of plastic chains compared to steel chains the chance of pulsation increases with the conveyor length. Please contact Habasit for more information.

Design guide
Elevating conveyors – basic design

Elevating conveyors

Recommended maximum conveyor elevation angle
3 ° to 5 ° is considered as maximum angle for Slat Top plastic chains. Depending on chain type, product to convey and environment higher values can be achieved. Contamination of the chain influences the coefficient of friction from chain and product. For higher inclination angles the use of molded rubber inserts (GripTop) or flights is needed to avoid unwanted sliding of conveyed products. Accumulation cannot occur if GripTop inserts are installed in the chain.
Note: Inserts must not contact wear strips. Please see the HabaCHAIN® Product Guide for detailed information on flights and molded rubber inserts.

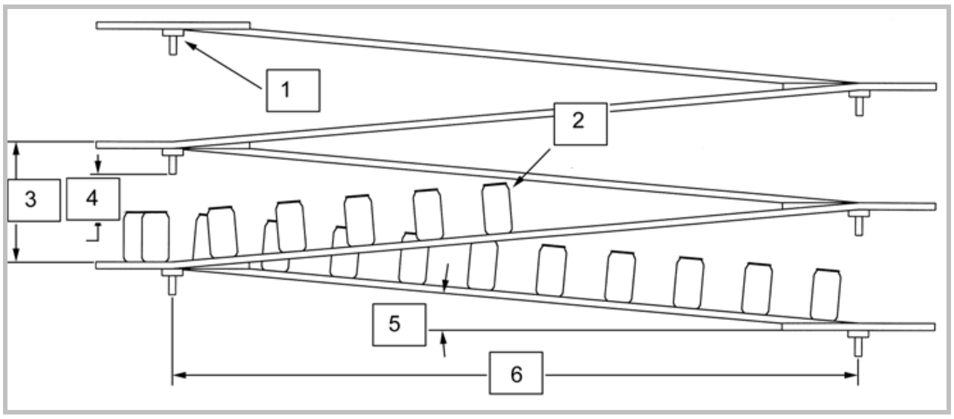
Design recommendations:
- Soft start / stop for drive in inclined and declined sections
- Dynamic tensioner
- Drive at the upper end of the conveyor



Design guide
Elevating conveyors – basic design

Alpine conveyors

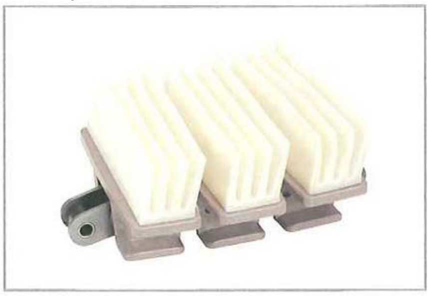
Elevating or lowering products in a small area can be accomplished using an alpine conveyor configuration. Alpine conveyors are usually designed for Multiflex series chains.



1 Disc wheel
2 Product
3 Pitch
4 Clearance
5 Pitch angle
6 Length between disc wheels

Gripper conveyors

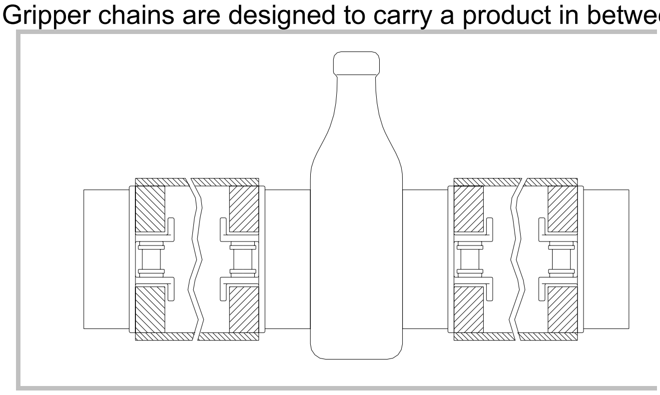
The use of two strands of gripper snap-on chains, either 1873T+D1 or 1873T+L4, will allow for vertical conveyance of a product.

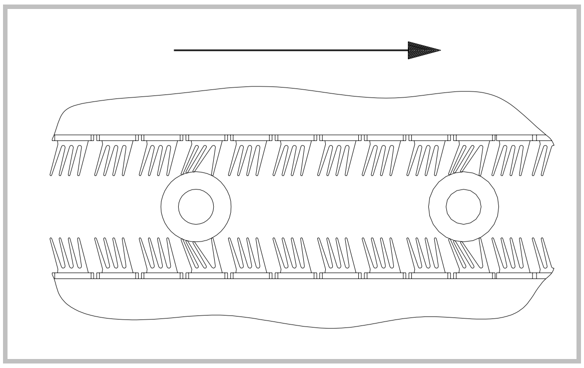


Snap-on 1873+L4 (Radius)

Snap-on 1873+D1 (Radius)

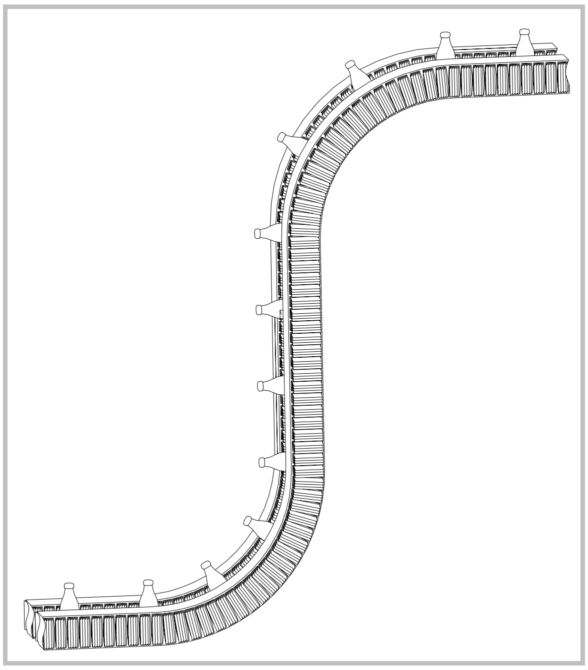
Gripper chains are designed to carry a product in between strands as shown below.

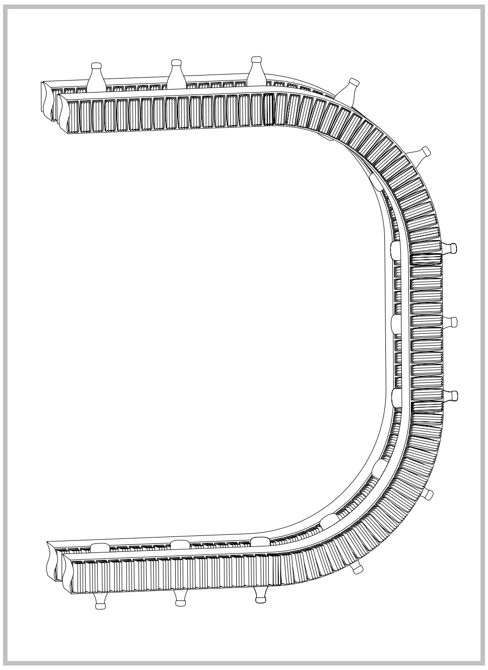




Design guide
Elevating conveyors – basic design

Various gripper conveyor configurations are possible:





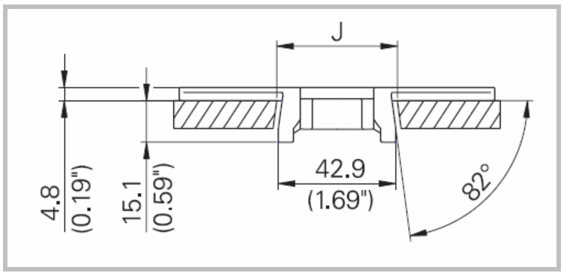
a) “S” shape: transfers a product from one level to another without changing its orientation
b) “C” shape: used when the product needs to be turned from one side to another over two levels
c) “U” shape: designed as an upside down “U”, this design allows for passage underneath the conveyor

Important things for designing a gripper conveyor:

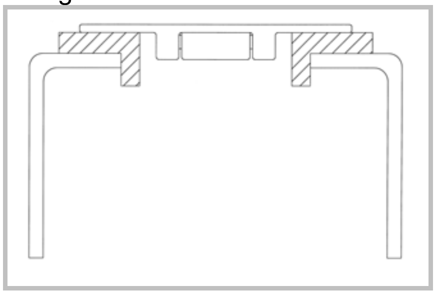
a) always keep the speed of the gripper chain greater than the speed of the infeed chain
b) allow adequate distance between products on the infeed chain. This will ensure a smooth transition onto the gripper chain
c) install a sufficient radius on the gripper chain where the transition between horizontal and vertical occurs for safe conveyance of the product
d) design the conveyor in a way to adjust the distance between the gripper chains

Design guide
Transport side

The following are examples of typical carryways for the transport side of both straight and radius Slat Top chains. For the necessary clearance between chain and wear strip please refer to the respective drawing in the HabaCHAIN® Product Guide or the Product Data Sheets. It is indicated with a “J” if there is a different clearance between straight and radius track needed.

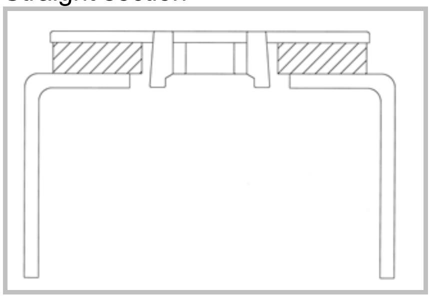


Straight running Slat Top chain (C0820, C0821, C0831)
Straight section

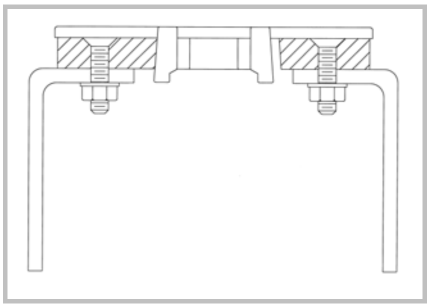


Radius Slat Top chain, beveled (C0879B, C0880B, C0880J, C0882B)

Straight section

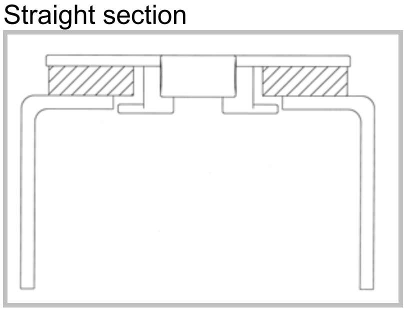


Radius section

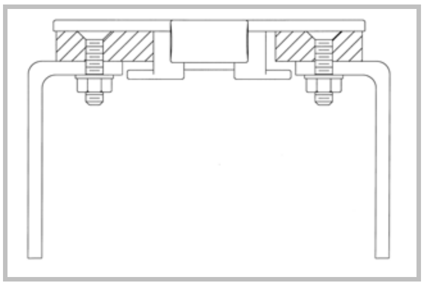


Radius Slat Top chain, tabbed (C0770T, C0879T, C0880T, C0882T, C0890T, C1061T)

Straight section



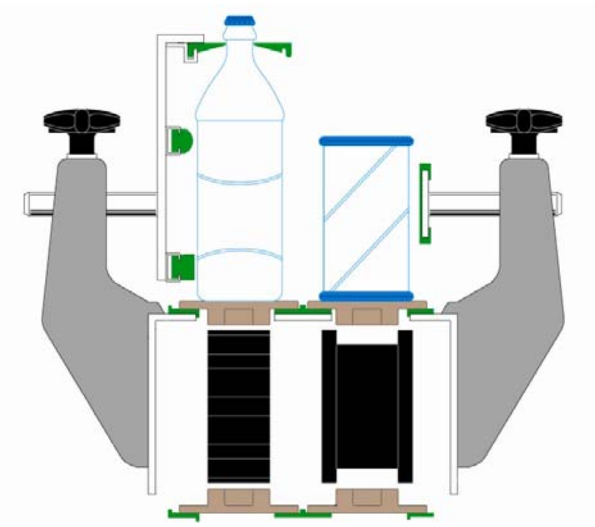
Radius section

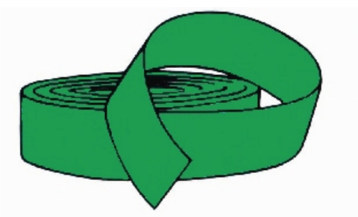


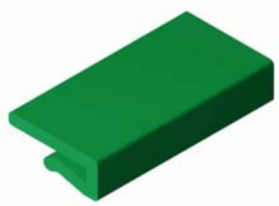
Design guide
Wear strip

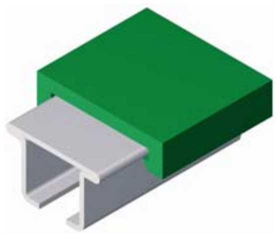
HabiPLAST®

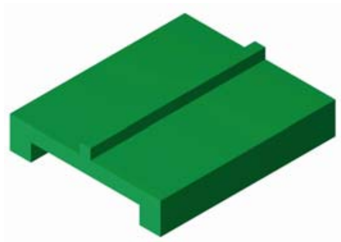
Habasit offers a wide range of HabiPLAST® plastic products like extruded profiles, sliding guides, machined tracks, etc. in different materials.

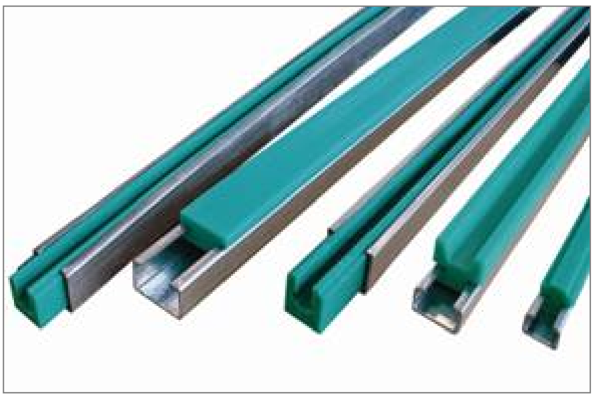












For detailed information please refer to the HabiPLAST® Product Guide.

Design guide
Wear strip

Wear strip material

Plastics
Plastic wear strips have a lower coefficient of friction than metal wear strips. But the thermal conductivity is worse. The following materials can be used:

Lubricated PA (Habilon Lub.Sol)
Habilon Lub.Sol (polyamide with incorporated lubricants) is recommended for dry applications where a low coefficient of friction is required. Polyamide expands because of moisture absorption. This has to be considered when using fasteners.

PE-UHMW (HabiPLAST® UHV)
This ultra high molecular weight polyethylene is recommended for demanding lubricated operating conditions.
It is chemically stable and unaffected by moisture. It is not recommended for dry operation on curves where chain load and/or speed is high. Compared to standard extruded PE-HMW (HabiPLAST® UHR) the tendency to embed abrasive particles is lower leading to decreased wear on the chain.

Lubricant impregnated wood
Used in dry abrasive applications, in particular on glass and paper applications.

POM (Acetal)
The majority of plastic chains is made of POM (Acetal). The use of wear strips made out of the same material as the chain itself is not recommended.

Metals
The higher hardness quality makes metal wear strips better suited for abrasive applications.

Carbon steel
Cold-rolled carbon steel is recommended with a low surface roughness. Use hardened or cold-formed steel with at least 25 HRC. Lubricants should contain an antirust agent.

Stainless steel
Cold-rolled stainless steel with a low surface roughness is recommended. Austenitic steels have the better resistance to corrosion than ferritic steels. When plastic chains are used, the stainless steel wear strips should have a hardness of at least 25 HRC. With softer wear strips the two different materials (steel and plastic) may cause the formation of black wear debris.

Bronze and brass
Can be used in non sparking and anti-static conditions, sometimes used with steel chains.

Aluminum
Due to its low wear resistance aluminum is not recommended.

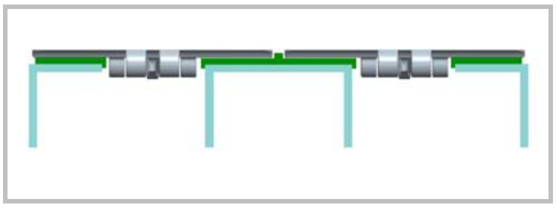
Operating conditions
Abrasive materials including broken glass, metal chips, sand, etc. can cause excessive wear to chains and wear strips.
Metal wear strips should be used instead of plastic under heavy abrasive conditions.

Wear strip replacement
Replacement criteria for wear strips:
- The thickness is decreased by more than 50% of the original thickness.
- Dirt or debris is embedded in the wear strip material in unacceptable quantities.
- Fixing bolts or blind rivets are protruding the wear strip.

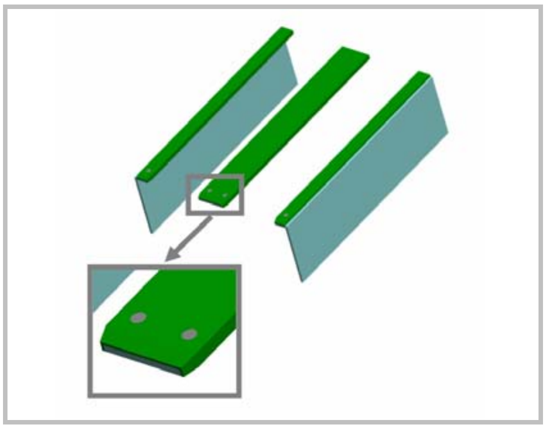
Replace corner tracks before the chain tab is touching the inside of the curve.

Wear strip design

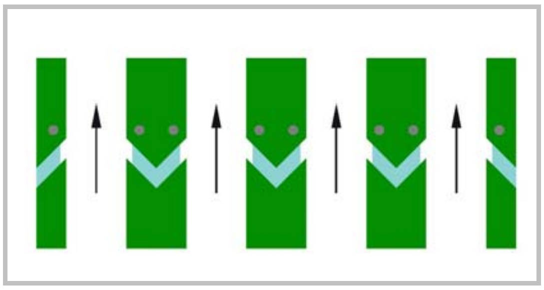
For wide chain types (more than 190.5 mm *(7.50“)* width) the chains should be guided at the hinge and supported at the wings. A full support of the wings is recommended.



Wear strips should always be chamfered at the beginning of the strip where they are fixed. Chamfering reduces the risk of impacts and chain-obstruction problems.
Please make sure that only the infeed side of the wear strip is fixed to the conveyor in order to enable the wear strip to elongate due to thermal expansion.



On straight sections longer than 3 m *(10ft)* and elevated temperatures higher than 40 – 70 °C *(104 – 158 °F)* it is recommended to divide the wear strip due to the thermal expansion of the strips. The clearance dimensions depend on the calculated elongation of thermal expansion.
It is recommended to cut the wear strips at double 45° angles for smooth chain transfers.

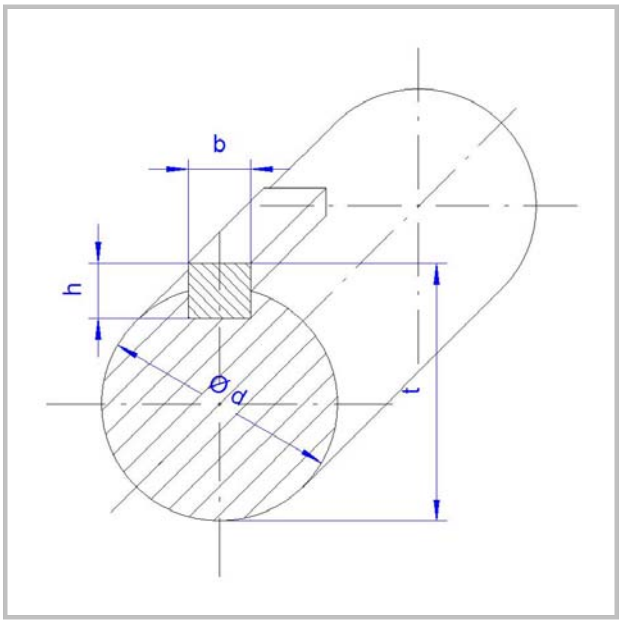


Thermal expansion calculation

For calculation of the thermal expansion of the wear strip you can use the same formula of chapter “Calculation Guide – 7. Effective chain length”.

Design guide
Shaft and keyway dimension

For HabaCHAIN® Multi-Hub sprockets and idlers we recommend the following shaft and keyway dimensions.



for metric shafts

Hub type		Nominal size [mm]	Tolerance [mm]		Tolerance class
			+	-	
H025RZ	d	25	0	0.052	h9
	t	28	0	0.35	
	b	8	0	0.036	h9
	h	7	0	0.09	h11
H030RZ	d	30	0	0.052	h9
	t	33	0	0.35	
	b	8	0	0.036	h9
	h	7	0	0.09	h11
H035RZ	d	35	0	0.062	h9
	t	38	0	0.35	
	b	10	0	0.036	h9
	h	8	0	0.09	h11
H040RZ	d	40	0	0.062	h9
	t	43	0	0.35	
	b	12	0	0.043	h9
	h	8	0	0.09	h11
H025RL	d	25	0	0.052	h9
H030RL	d	30	0	0.052	h9
H035RL	d	35	0	0.062	h9
H040RL	d	40	0	0.062	h9

for imperial shafts

Hub type		Nominal size *[inch]*	
H100RZ	d	*1*	*1.00*
	t		*1.111*
	b	$^{1}/_{4}$	*0.25*
	h	$^{1}/_{4}$	*0.25*
H118RZ	d	$1\ ^{3}/_{16}$	*1.1875*
	t		*1.299*
	b	$^{1}/_{4}$	*0.25*
	h	$^{1}/_{4}$	*0.25*
H125RZ	d	$1\ ^{1}/_{4}$	*1.25*
	t		*1.361*
	b	$^{1}/_{4}$	*0.25*
	h	$^{1}/_{4}$	*0.25*

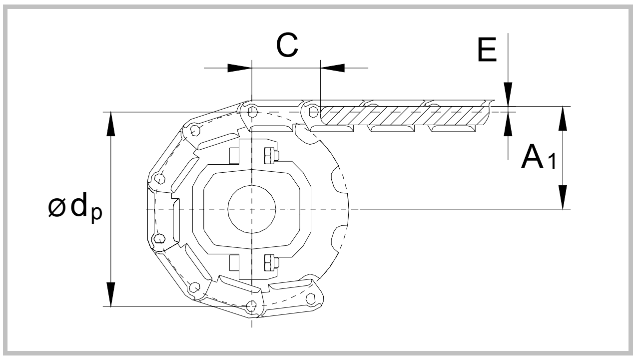
for imperial shafts (continuation)

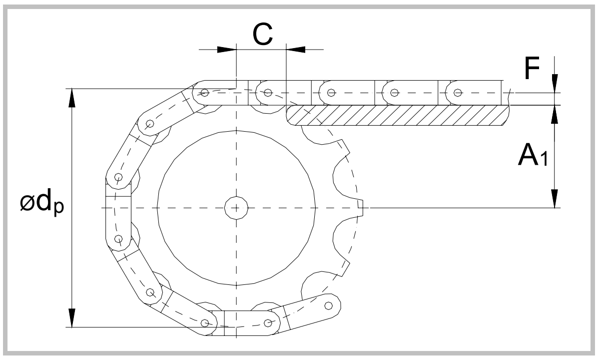
Hub type		Nominal size *[inch]*	
H144RZ	d	$1\ ^{7}/_{16}$	*1.4375*
	t		*1.605*
	b	$^{3}/_{8}$	*0.375*
	h	$^{3}/_{8}$	*0.375*
H150RZ	d	$1\ ^{1}/_{2}$	*1.50*
	t		*1.667*
	b	$^{3}/_{8}$	*0.375*
	h	$^{3}/_{8}$	*0.375*
H100RL	d	*1*	*1.00*
H118RL	d	$1\ ^{3}/_{16}$	*1.1875*
H125RL	d	$1\ ^{1}/_{4}$	*1.25*
H144RL	d	$1\ ^{7}/_{16}$	*1.4375*
H150RL	d	$1\ ^{1}/_{2}$	*1.50*

Design guide
Sprocket and idler positioning

Dimensions for A_1, C and E, F

The chain tends to raise and fall slightly when it enters the sprocket due to the polygon effect (chordal action). For this reason, the sprocket should be installed slightly lower than the upper side of the wear strip.
The A_1, C and E, F dimension is different depending on the design and the pitch of the respective chain type.





For HabaCHAIN® Multi-Hub sprockets the following dimensions for A_1, C and E according to the table below are intended as a recommendation for aligning the sprocket with the wear strip.

for HabaCHAIN® Multi-Hub sprockets

Chain type	Multi-Hub sprocket	Number of teeth	Diam. of pitch dp		A1		C		E	
					0/+2mm	0/+0.08"	0/+2mm	0/+0.08"		
			mm	*inch*	mm	*inch*	mm	*inch*	mm	*inch*
770T	C1060G16	16	129.9	*5.11*	67.5	*2.65*	25.4	*1.00*	2.5	*0.10*
	C1060G18	18	146.0	*5.75*	75.5	*2.97*	25.4	*1.00*		
820	C0820G21	21	128.9	*5.07*	67.7	*2.66*	38.1	*1.50*	3.2	*0.13*
	C0820G23	23	142.0	*5.59*	74.2	*2.92*	38.1	*1.50*		
	C0820G25	25	153.8	*6.06*	80.1	*3.16*	38.1	*1.50*		
821, LBP 821, LBP 821 SB	C0821G25	25	153.2	*6.03*	79.7	*3.14*	38.1	*1.50*	3.1	*0.12*
831	C0820G21	21	128.9	*5.07*	66.9	*2.63*	38.1	*1.50*	2.4	*0.09*
	C0820G23	23	142.0	*5.59*	73.4	*2.89*	38.1	*1.50*		
	C0820G25	25	153.8	*6.06*	79.3	*3.12*	38.1	*1.50*		
879B, 879T	C0880G10	10	123.3	*4.85*	64.5	*2.54*	38.1	*1.50*	2.8	*0.11*
	C0880G12	12	147.2	*5.80*	76.4	*3.01*	38.1	*1.50*		
880B, 880J, 880T, 880M, 890T	C0880G10	10	123.3	*4.85*	65.3	*2.57*	38.1	*1.50*	3.6	*0.14*
	C0880G12	12	147.2	*5.80*	77.2	*3.04*	38.1	*1.50*		
882B, 882T, 882TG, LBP 882T, LBP 882T SB	C0882G12	12	147.2	*5.80*	78.3	*3.09*	38.1	*1.50*	4.7	*0.19*
1061M	C1060G16	16	129.9	*5.11*	68.3	*2.68*	25.4	*1.00*	3.3	*0.13*
	C1060G18	18	146.0	*5.75*	76.3	*3.00*	25.4	*1.00*		
1061T	C1060G16	16	129.9	*5.11*	67.5	*2.65*	25.4	*1.00*	2.5	*0.10*
	C1060G18	18	146.0	*5.75*	75.5	*2.97*	25.4	*1.00*		

Design guide
Sprocket and idler positioning

For differing numbers of teeth or for solid sprockets you can calculate the A_1 dimension according to the following formulas:

$A_1 = Ø\ d_p / 2 + E$ [mm], *[inch]*

$A_1 = Ø\ d_p / 2 - F$ [mm], *[inch]*

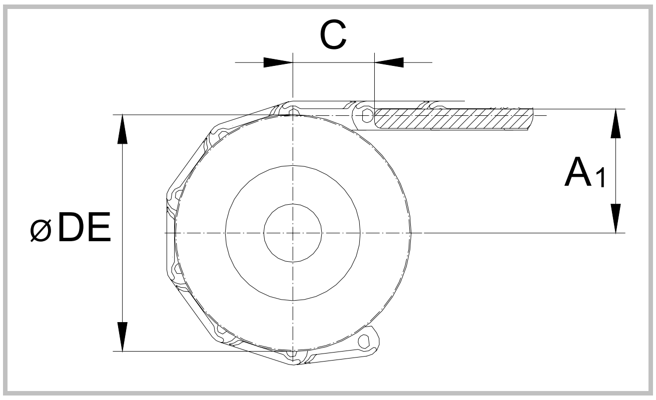
Please use the below indicated values for E or F according to the chain type.

for HabaCHAIN® solid sprockets

Chain type	Solid sprocket	E	
		mm	*inch*
800	C0821M--	3.5	*0.14*
810	C0810M--	3.5	*0.14*
820	C0820M--	3.2	*0.13*
821	C0821M--	3.1	*0.12*
831	C0820M--	2.4	*0.09*
843 series	#40, 08-B	5.8	*0.23*
863 series	#60, 12-B	10.3	*0.41*
879	C0880M--	2.8	*0.11*
880	C0880M--	3.6	*0.14*
881 series	C0881M--	3.5	*0.14*
882 series	C0882M--	4.7	*0.19*
890T	C0880M--	3.6	*0.14*
963 series	#60, 12-B	10.3	*0.41*
1843T	#40, 08-B	6	*0.24*
1873 series, 2873, 3873	#60, 12-B	10.3	*0.41*
1874T	#60, 12-B	11.3	*0.44*
7100K0248	C7100M16--248	10	*0.39*
7100K0325	C7100M12--325	12.5	*0.49*
7100K0405	C7100M12--405	12.2	*0.48*

Chain type	Solid sprocket	F	
		mm	*inch*
600 series	C0600M--	14.2	*0.56*
1100, 1110T	C1100M--	5.7	*0.22*
1150, 1151T	C1150M--	8.7	*0.34*
1200, 1210T, 3200, 3210T	C1200M-- C3200M--	10.1	*0.40*
1250, 1251T	C1250M--	15.9	*0.63*
1400, 1410T	C1400M--	19.1	*0.75*
1700, 1701T	C1700M--	12.1	*0.48*
NH78	CNH78M--	14.3	*0.56*
40P	#40, 08-B	6.2	*0.24*
60P	#60, 12-B	8.6	*0.34*
80P	#80, 16-B	12	*0.47*

Idler positioning
Smoothest running is achieved when the idler wheel is installed slightly lower than the upper side of the wear strip.



Design guide
Sprocket and idler positioning

for HabaCHAIN® Multi-Hub idlers

Chain type	Multi-Hub idler	Equivalent number of teeth	Diameter DE		A1		C	
					0/+2mm	0/+0.08"	0/+2mm	0/+0.08"
			mm	*inch*	mm	*inch*	mm	*inch*
820	C0820L21	21	130.0	*5.12*	68.0	*2.68*	38.1	*1.50*
	C0820L23	23	142.5	*5.61*	74.0	*2.91*	38.1	*1.50*
	C0820L25	25	154.5	*6.08*	80.0	*3.15*	38.1	*1.50*
831	C0820L21	21	130.0	*5.12*	68.0	*2.68*	38.1	*1.50*
	C0820L23	23	142.5	*5.61*	74.0	*2.91*	38.1	*1.50*
	C0820L25	25	154.5	*6.08*	80.0	*3.15*	38.1	*1.50*
879B	C0820L21	21	130.0	*5.12*	68.0	*2.68*	38.1	*1.50*
	C0820L23	23	142.5	*5.61*	74.0	*2.91*	38.1	*1.50*
	C0820L25	25	154.5	*6.08*	80.0	*3.15*	38.1	*1.50*
880B, 880J, 880M	C0820L21	21	130.0	*5.12*	68.0	*2.68*	38.1	*1.50*
	C0820L23	23	142.5	*5.61*	74.0	*2.91*	38.1	*1.50*
	C0820L25	25	154.5	*6.08*	80.0	*3.15*	38.1	*1.50*

for HabaCHAIN® solid idlers

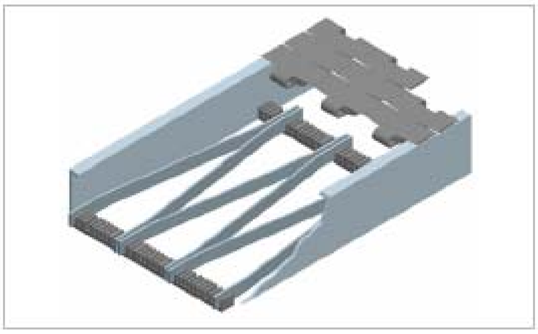
Chain type	Solid idler	Equivalent number of teeth	Diameter DE		A1		C	
					0/+2mm	0/+0.08"	0/+2mm	0/+0.08"
			mm	*inch*	mm	*inch*	mm	*inch*
810, 820, 831, 879B, 880B, 881B	C0810L17	17	105.0	*4.13*	55.5	2.19	38.1	*1.50*
	C0810L19	19	117.1	*4.61*	61.5	2.42	38.1	*1.50*
	C0810L21	21	130.1	*5.12*	68.0	2.68	38.1	*1.50*
	C0810L23	23	142.0	*5.59*	74.0	2.91	38.1	*1.50*
	C0810L25	25	154.2	*6.07*	80.0	3.15	38.1	*1.50*
	C0810L27	27	166.6	*6.56*	86.5	3.41	38.1	*1.50*
	C0810L31	31	191.3	*7.53*	98.5	3.88	38.1	*1.50*
7100K0248	C7100L16--248	16	119.5	*4.70*	62.5	2.46	25.4	*1.00*
7100K0325	C7100L12--325	12	117.8	*4.64*	62.0	2.44	33.5	*1.32*
7100K0405	C7100L12--405	12	123.0	*4.84*	64.5	2.54	35.5	*1.40*

Design guide
Return side

There are many concepts for chain return used on the market.

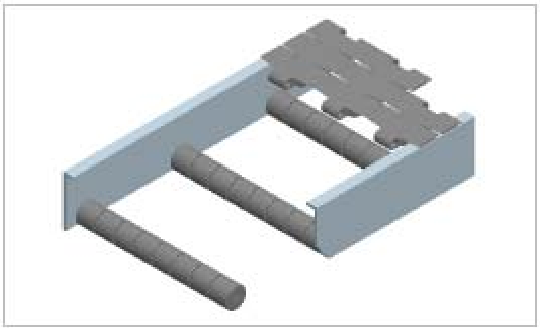
Serpentine
Benefits
- Lower noise level compared to other concepts
- Wear is constant over the chain width
- Self cleaning

Disadvantages
- Complex construction and less accessibility for maintenance
- Higher friction compared to other concepts

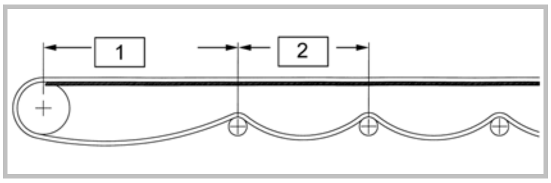


Roller
Benefits
- Simple construction and good accessibility for maintenance
- Debris are ejected by the movement of the chain

Disadvantages
- Only line contact between chain and roller
- Rollers must be able to rotate freely at all times. Small rollers may cause noise (roller diameter should be at least twice the minimum back flexing radius of the chain)
- Distance between rollers must be staggered to eliminate harmonics

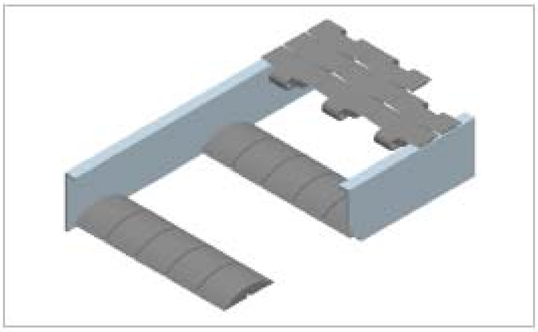


1 460 mm – 610 mm *(18” – 24”)*
2 610 mm – 1220 mm *(24” – 48”)*



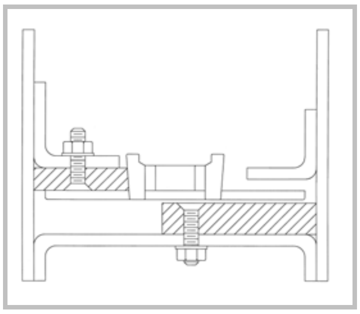
Guide shoes
Benefits
- Good accessibility for maintenance
- Simple construction
- Debris are ejected by the movement of the chain
- Suitable for LBP chains

Disadvantages
- Risk of uneven wear on the chain surface when abrasive particles are embedded in the plastic guide shoes
- Higher friction compared to other systems
- Minimum guide shoe radius should be 200 mm *(8”)*

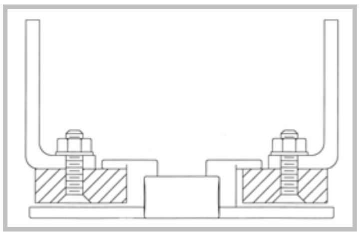


Design guide
Return side

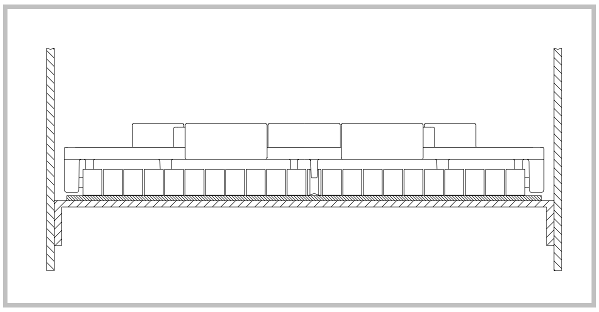
Radius Slat Top chain, beveled (C0879B, C0880B, C0880J, C0882B)
Return side, radius section



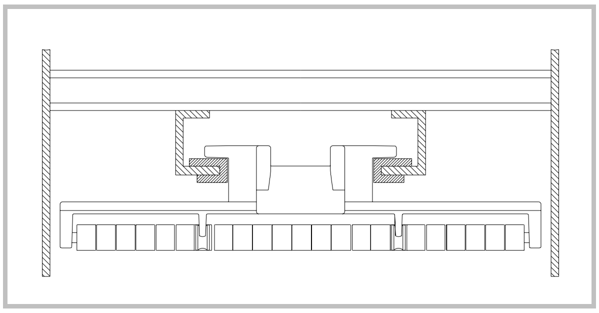
Radius Slat Top chain, tabbed (C0770T, C0879T, C0880T, C0882T, C0890T, C1061T)
Return side, radius section



Low back pressure return side constructions
LBP chains in return can even run directly on the rollers or if a tabbed LBP chain is used they can be guided by the tab.



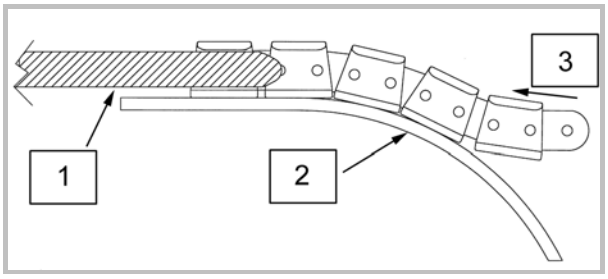
Straight running LBP chain (LBP 821)



Tabbed LBP chain (LBP 882T)

Entry radius for return wear strips
Habasit recommends a minimum entry radius of 150 mm (*6,0 "*)

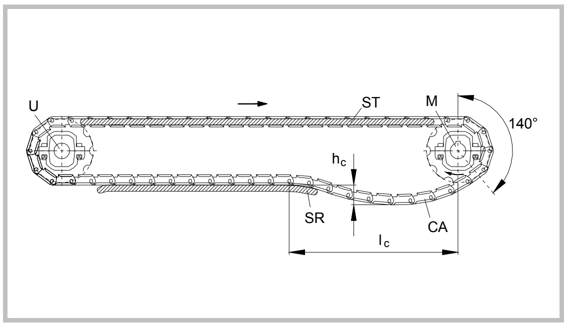
1 Wear strip
2 Guide with proper entry radius
3 Travel direction



Design guide
Catenary sag

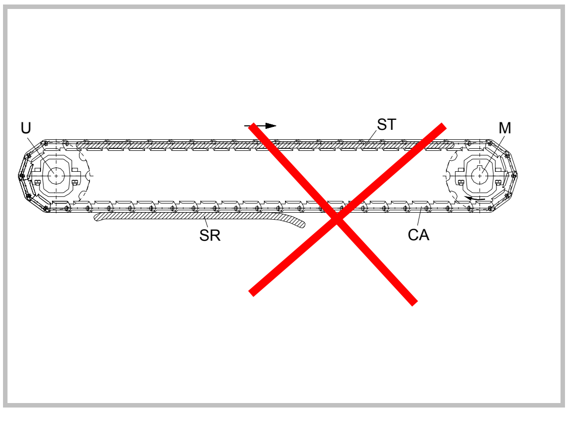
Catenary sag (chain sag) is an unsupported length of the chain for absorbing chain length variations caused by thermal expansion/contraction and load changes of the chain. In addition, due to its weight the sag exerts tension to the chain, which is necessary for firm engagement of the sprockets. This tension again is depending on the length l_C and height h_C of the sag.

A proper catenary sag is very important for correct chain operation.
We recommend a catenary sag height h_C of 25 to 100 mm *(1" to 4").*
Should it exceed this value, one or more links need to be removed. The correct angle of wrap around the sprocket should not be less than 140°.
The chain return can be over rollers or guides covered with wear strips. In order to ensure the required catenary sag, it is important that the first roller or the beginning of the wear strip be set at a sufficient distance from the drive sprocket.

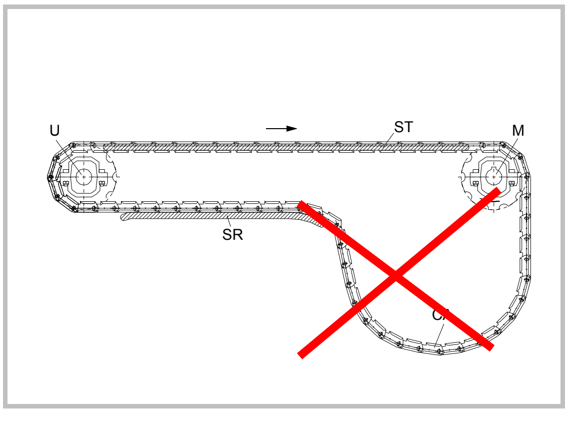


l_C 460 mm – 610 mm *(18" – 24")*
h_C 25 mm – 100 mm *(1" – 4")*
SR return shoe or roller

Insufficient catenary sag results in greater wear on the link hinges, causing increased link hinge loading.



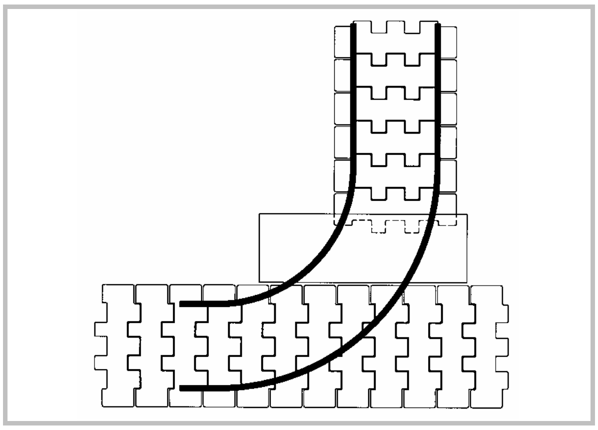
Excessive sag reduces the wrapping angle and this results in a reduction of the transfer force. This also causes chain pulsations.



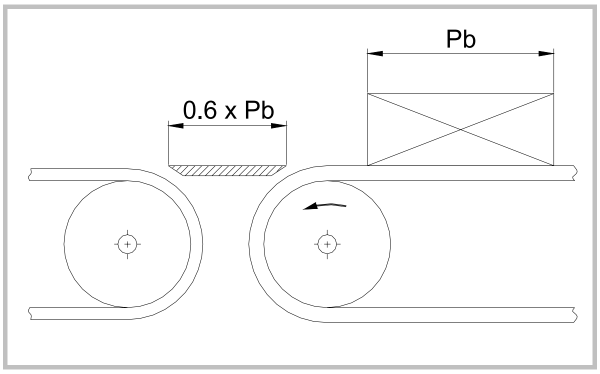
Design guide
Transfer

Transferring product from one conveyor line to another can be done via a side transfer or a dead plate transfer.

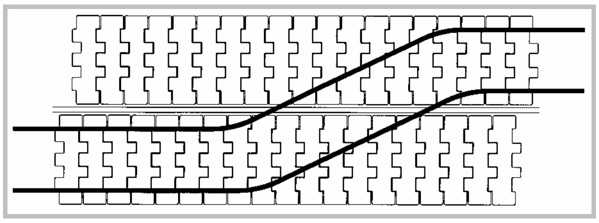
Dead plate transfer
The dead plate should be installed aligned with or slightly higher than the outfeed chain. All edges should be chamfered to allow for a smooth transfer.



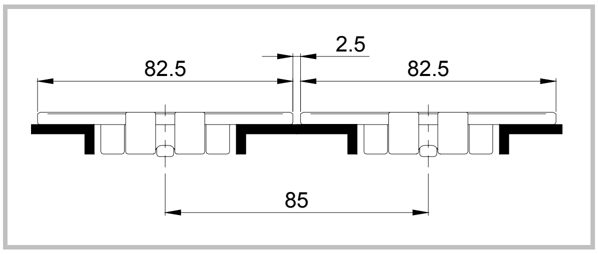
Self-clearing transfer
According to experience it is noted that a dead plate transfer with a length of max. 0.6 x product base diameter (Pb) will result in a continuous product flow.



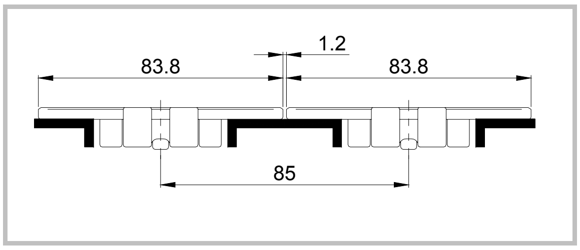
Side transfer
Side transfers are the most common way of transfer. Make sure the chains are level or that the outfeed chain is slightly lower than the infeed chain. Proper wear strip clearance, correct guide rail positioning and chain speeds are critical to efficient product flow. Maximum speed difference from lanes is 15-20 m/min *(50-65 ft/min).*
Make sure that the chains do not interfere with each other on the return side.



Pressureless combiners have a common pitch of 85 mm. Using 82.5 mm *(3.25")* wide chains a gap between the single strands of 2.5 mm *(0.1")* is resulting.



In case chain gaps need to be minimized the use of chains in 83.8 mm *(3.30")* width is recommended with a gap of 1.2 mm *(0.05").*

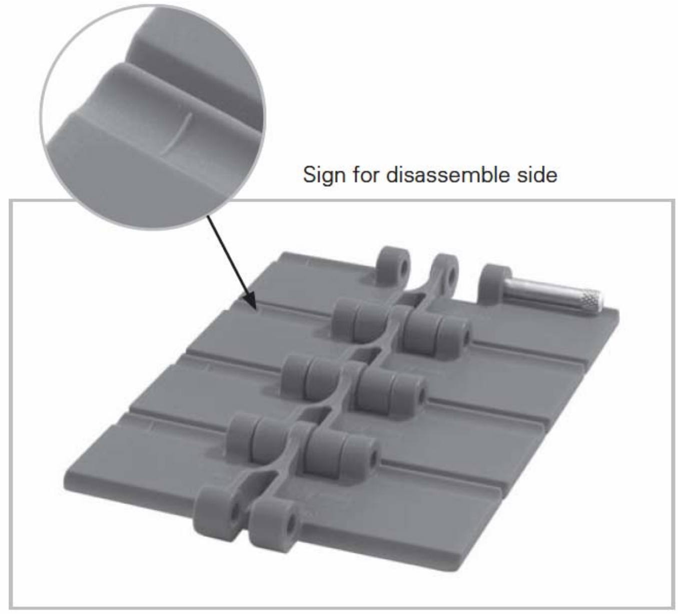


Design guide
Design aspects for chain installation

Assembly and disassembly
Consider enough space for assembly and disassembly of the chain on the conveyor. Usually the best position to assemble or disassemble a chain on a conveyor is near the driving sprocket.

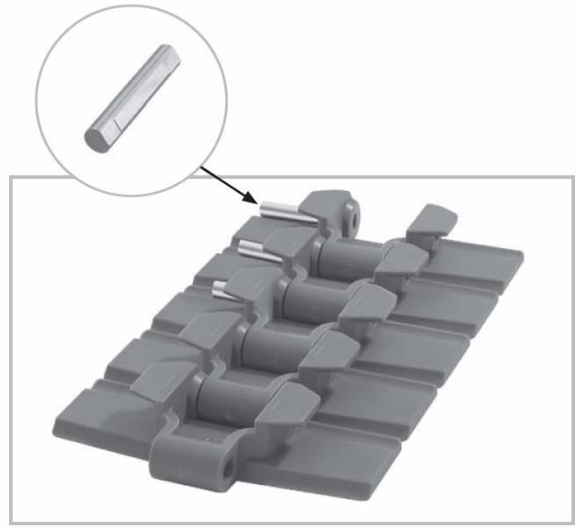
Slat Top chains with knurled pin (C0820, C0821, C0831)

For assembly and disassembly of the chain use a hammer and a drift pin.
For assembly plug the knurled pin from the correct side (opposite to the mark on the backside of the top plate) in the appropriate chain link. Make sure to insert the smooth (unknurled) end of the pin first. Then drive the pin through until the pin is centered in the link.
For disassembly make sure you drive the pin out of the link from the side where the sign is marked on the backside of the top plate.



Slat Top chains with D-shape pin (C0770, C0879, C0880, C0882, C0890, C1061)

For assembly and disassembly of the chain use a hammer and a drift pin.
For assembly plug the D-shape pin in the appropriate chain link and drive the pin through until the pin is centered in the link.
For disassembly drive the pin out of the chain link.



Flexi chains (C7100 series) assembly

For assembly you don’t need a tool at most a small hammer maybe.
Connect both chain ends by hand. Plug the bushing with the correct orientation in the appropriate chain link. Make sure the rounded chamfer of the bushing points contrary to the direction of travel. Push the bushing by hand or with slight hammer punches in the chain link until the head of the bushing is flush with the chain body.

Design guide
Design aspects for chain installation

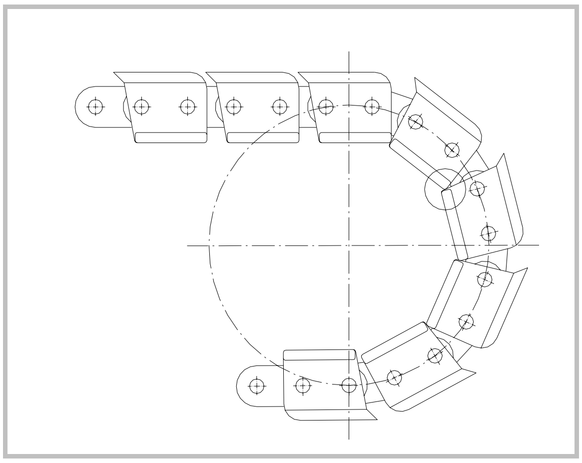
Flexi chains (C7100 series) disassembly

For disassembly use a small screwdriver or a self-tapping screw.
Start extracting the chain bushing with a small screwdriver by inserting the screwdriver into the lateral recess of the bushing and lever the bushing out of the chain.
Then disconnect by hand the chain links.
You can also use a self-tapping screw for chain disassembly. In this case screw it in the central hole of the bushing and pull the bushing out of the chain link.
Then disconnect by hand the chain links.

Minimum sprocket diameter for Snap-on chains

In order to avoid damaging of the top plates the following minimum admissible sprocket diameters are required:

Snap-on chain type	Pitch base chain	Mimimum sprocket diameter
	inch	teeth
843	*1/2*	17
843C	*1/2*	17
863	*3/4*	17
863T	*3/4*	19
963	*3/4*	17
963T	*3/4*	19
1843T	*1/2*	17
1873T+T	*3/4*	19
1873T	*3/4*	19
1873+D1	*3/4*	19
1873+L4	*3/4*	19
1874T	*3/4*	19
2873SD	*3/4*	19



Calculation guide
Chain calculation procedure

After having preselected a suitable chain type from the HabaCHAIN® Product Guide, the calculation has to verify and proof the suitability of this chain for the application.
The following formulas are partially simplified. For abbreviations, glossary of terms and conversion of units see tables in the Appendix.
Use the HabaCHAIN® Calculation Program for detailed calculations.

Before starting the calculation you need to know the following data:

Measure	Unit	Value
Chain type		
Chain width	[mm], *[inch]*	
Chain material		
Chain speed	[m/min], *[ft/min]*	
Lubrication	yes/no	
Sprocket teeth		
Drive shaft diameter	[mm], *[inch]*	
Gearbox efficiency	[%]	
Wear strip material		
Corner track material		
Number of corners		
Product material		
Product load	[kg/m], *[lb/ft]*	
Product quantity	[pcs./hr]	
Product weight	[kg], *[lb]*	
Product diameter or length	[mm], *[inch]*	
Product width	[mm], *[inch]*	
Product temperature	[°C], *[°F]*	
Environment temperature	[°C], *[°F]*	
Abrasive condition	yes/no	
Operation time	[hrs/day]	
Starts + Stops	[qty./day]	
Accumulation	yes/no	
Accumulation length	[mm], *[inch]*	

Straight conveyor		
Conveyor length	[mm], *[inch]*	
Inclination height, or	[mm], *[inch]*	
Inclination angle	[°]	

Radius conveyor (from idle to drive)		
Straight section 1 length	[mm], *[inch]*	
Radius 1	[mm], *[inch]*	
Straight section 2 length	[mm], *[inch]*	
Radius 2	[mm], *[inch]*	
Straight section 3 length	[mm], *[inch]*	
Radius 3	[mm], *[inch]*	
Straight section 4 length	[mm], *[inch]*	

Does the curves have corner disks?	yes/no	

The following calculation procedure is proposed:

Calculation guide
Chain calculation procedure

Step	Procedure	Typical formula (other diverted formula see detailed instructions)	Refer to page
1	Calculate the **effective tensile force (chain pull) F_E**, generated during conveying process near the driving sprocket, taking in account product weight, chain weight, friction values, inclination height, product accumulation.	$F_E = (2\ m_B + m_P)\ l_0 \cdot \mu_G \cdot g$ [N], *[lbf]* $F_E = [(2\ m_B + m_P)\ l_0 \cdot \mu_G + m_P \cdot \mu_P \cdot l_a]\ g$ [N], *[lbf]* $F_E = [(2\ m_B + m_P)\ l_1 \cdot \mu_G + m_P \cdot h_0]\ g$ [N], *[lbf]* $F_E = [(2\ m_B + m_P)\ l_1 \cdot \mu_G + m_P \cdot \mu_P \cdot l_a + m_P \cdot h_0]\ g$ [N], *[lbf]*	44
2	Calculate the **adjusted tensile force (adjusted chain pull) F_S** multiplying with the adequate service factor of your application, taking into account frequent start/stops, direct or soft start drive.	$F_S = F_E \cdot c_S$ [N], *[lbf]*	45
3	Calculate the **admissible tensile force F_{adm}**. Speed and high or low temperature may limit the max. admissible tensile force below nominal tensile strength F_N (for F_N see Product Data Sheet).	$F_{adm} = F_N \cdot c_T \cdot c_V$ [N], *[lbf]*	46
4	Verify the strength of the selected chain by **comparison of F_S** with the **F_{adm}**.	$F_S \leq F_{adm}$ [N], *[lbf]*	47
5	Check the dimensioning of the **driving shaft.**	$f = 5/384 \cdot F_W \cdot lb^3 / (E \cdot I)$ [mm], *[inch]* $T_M = F_S \cdot b_0 \cdot d_P/2 \cdot 10^{-3}$ [Nm], *[lbf inch]*	48
6	Calculate the **catenary sag** dimensions.	$F_C = l_C^2 \cdot m_B \cdot g / (8 \cdot h_C)$ [N], *[lbf]*	49
7	Establish the effective **chain length** taking into account the thermal expansion.	$l_g = 2 \cdot l_0 + d_P / 1000 + 2.66 \cdot (h_C / 1000)^2 / l_C$ [m], *[ft]*	50
8	Calculate the required shaft **driving power**.	$P_M = F_S \cdot v / 60$ [W] $P_M = F_S \cdot v / 33000$ *[HP]*	51
9	Check the **chemical resistance** of the chain material selected for your specific process.	Table of chemical resistance (see Product Guide)	
10	Check your **conveyor design**, if it fulfills all calculated requirements.		

Calculation guide
1. Effective tensile force (chain pull) F_E

Horizontal straight chain without accumulation

$F_E = (2\ m_B + m_P)\ l_0 \cdot \mu_G \cdot g$ [N], *[lbf]*

Horizontal straight chain with accumulation, simplified

$F_E = [(2\ m_B + m_P)\ l_0 \cdot \mu_G + m_P \cdot \mu_P \cdot l_a]\ g$ [N], *[lbf]*

Inclined conveyor without accumulation

$F_E = [(2\ m_B + m_P)\ l_1 \cdot \mu_G + m_P \cdot h_0]\ g$ [N], *[lbf]*

Inclined conveyor with accumulation, simplified

$F_E = [(2\ m_B + m_P)\ l_1 \cdot \mu_G + m_P \cdot \mu_P \cdot l_a + m_P \cdot h_0]\ g$ [N], *[lbf]*

Further analyses of tensile forces caused by accumulated products

Above equations with accumulation are based on the simplification that the product load per m is the same over the accumulation length as when moving with the conveyor. This is generally not the case.
In reality the density of the product distribution over the accumulation length $\mathbf{l_a}$ will be higher (can be double or 3 times). Since this value is often not known it is common practice to use the same product load value for accumulation as for conveying. In this case the above formulas are used. The calculated force is somewhat too low, but normally not critical for straight chains.
If the accumulation product load per m is known, and for more accurate calculation, it is proposed to replace $\mathbf{m_P}$ in the term $\mathbf{m_P \cdot \mu_P \cdot l_a}$ by $\mathbf{m_{Pa}}$.
The following formulas result:

Horizontal straight chain with accumulation

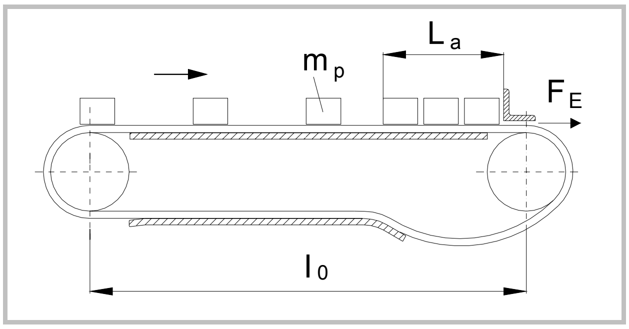
$F_E = [(2\ m_B + m_P)\ l_0 \cdot \mu_G + m_{Pa} \cdot \mu_P \cdot l_a]\ g$ [N], *[lbf]*

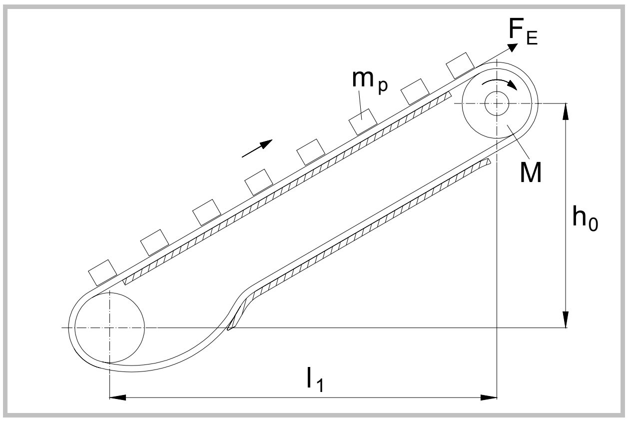
Inclined conveyor with accumulation

$F_E = [(2\ m_B + m_P)\ l_1 \cdot \mu_G + m_{Pa} \cdot \mu_P \cdot l_a + m_P \cdot h_0]\ g$ [N], *[lbf]*

F_E =	Effective tensile force [N], *[lbf]*
m_B =	Weight of chain [kg/m], *[lbs/ft]*
m_P =	Weight of conveyed product [kg/m], *[lbs/ft]*
m_{Pa} =	Weight of accumulated product [kg/m], *[lbs/ft]*
μ_G =	Coefficient of friction chain to slider support
μ_P =	Coefficient of friction chain to product
l_0 =	Conveying length [m], *[ft]*
h_0 =	Height of elevation [m], *[ft]*
l_a =	Length of accumulation [m], *[ft]*
l_1 =	Horizontal projection of conveying length [m], *[ft]*
g =	Acceleration factor due to gravity (9.81 m/s^2, *32.2 ft/s^2*)

values for μ_G, μ_P see chapter "Material properties"





Radius chains

Radius chains have higher friction losses than straight chains due to the radial forces directed to the inside of the curve. It also has to be taken into account, that in the chain curves the tensile forces are not distributed over the total link width but are concentrated at the outer link edge.

Admissible tensile forces (F_{adm}) for radius chains (see also page 47)

Since the chain pull in the curve is concentrated at the outer link edge, the admissible chain force is limited.
Therefore the absolute tensile force F_{SR} is applied for comparison with the nominal chain strength F_N.

$F_{SR} = F_E \cdot c_s \le F_{adm}$ [N], *[lbf]* (radius chains only)

For calculation of radius chains please ask Habasit for the HabaCHAIN® calculation tool.

Note

Due to the concentration of the chain pull (tensile forces) on the outer link edge at curve end, the applicable number of curves is very limited. In practice, 1 to 2 curves are often used. For long radius chains it is advisable to place the curve as near to the idling shaft as possible (see chapter "Horizontal conveyors – basic design").

Calculation guide
2. Adjusted tensile force (adjusted chain pull) F_S

$F_S = F_E \cdot c_s$ [N], *[lbf]*

(Symbols see chapter "List of abbreviations")

F_S = Adjusted tensile force (chain pull) [N], *[lbf]*
F_E = Effective tensile force [N], *[lbf]*
c_s = Service factor (see table below)

Service factor c_s
Service factors take into account the impact of stress conditions reducing the chain life.

Operating condition	**Service factor c_s** Standard straight chains		Radius chain curves with 90° (*)
	Standard head drive	Center drive (uni- and bi-directional)	Standard head drive
Start-up prior to loading	1	1.2	1.6 (*)
Frequent start/stop during process (more than once per hour)	+ 0.2	+ 0.2	+ 0.2
Speed greater 30 m/min *(98 ft/min)*			+ 0.2

Note: Drive with soft start is recommended and is mandatory for frequent start/stop and start-up with full load.

(*) The radius chain service factor depends on the angle of the curve

Calculation guide
3. Admissible tensile force F_{adm}

Speed and temperature reduce the maximum admissible tensile force F_{adm} below nominal tensile strength F_N. For nominal tensile strength F_N please refer to the Product Data Sheets.

$F_{adm} = F_N \cdot c_T \cdot c_V$ [N], *[lbf]*

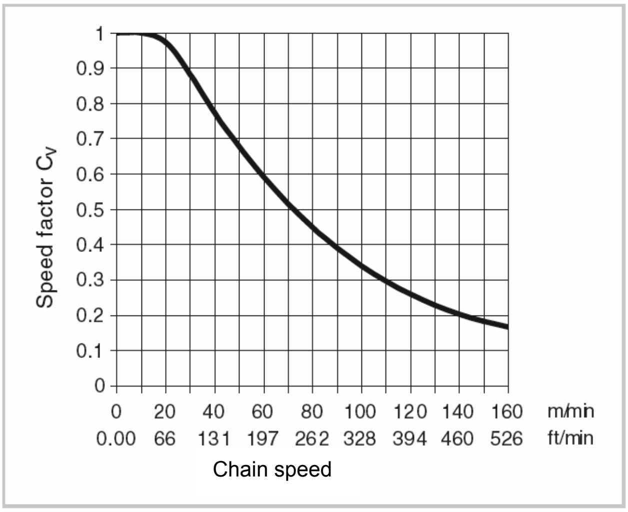
F_{adm}	=	Admissible tensile force [N], *[lbf]*
F_N	=	Nominal tensile strength [N], *[lbf]*
c_T	=	Temperature factor (see diagram below)
c_V	=	Speed factor (see diagram below)

For radius chain calculations the absolute tensile forces are applied.

Speed factor c_V
The chain speed increases the stress in the chain mainly at the point where the direction of movement is changing:

- driving sprockets
- idlers
- return rollers

The centrifugal forces and sudden link rotations increase the forces in the chain and the chain wear. These impacts are substantially increasing above 30 m/min *(98 ft/min)*.



Lifetime (Influence of chain length and sprocket / roller size)
The calculation with c_v is not taking into account the influence of the conveyor length and sprocket / roller sizes used. These design features are influencing the lifetime, because the number and angle of link rotation are depending on them. The bigger the number and / or angle of rotation the greater the wear in the link and the earlier the chain will be lengthened to its limit. General rule:

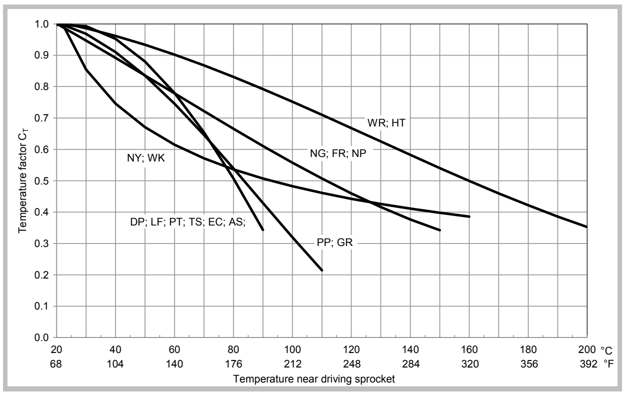
- Doubling of the length is reducing the number of link rotations by half and vice versa.
- Doubling the sprocket / roller diameter is reducing the angle of link rotation by half and vice versa.

Consequently the lifetime increases / decreases with the same relation. For the lifetime, the lengthening of the chain is a main criterion. The initial length is measured after running-in, generally approx. 1 hour.

General rule: The maximum **allowable chain lengthening is approx. 3%** of the chain length. When this value is reached, the chain should be exchanged. The lifetime cannot easily be predicted since the rate of wear in the links and consequently the lengthening depends on the process and environmental conditions (dust, sand and other contaminations).

Temperature factor c_T
The measured breaking strength (tensile test) of thermoplastic material increases at temperatures below 23 °C *(73 °F)*. At the same time other mechanical properties are reduced at low temperatures.
For this reason follows:

At temperatures ≤ **23 °C *(73 °F)*: $c_T = 1$**



For admissible temperature ranges see Material Overview of HabaCHAIN® Product Guide.

Calculation guide
4. Verification of the chain strength

The selected chain is suitable for the application, if the adjusted tensile force (chain pull) F_S is smaller or equal to the admissible tensile force F_{adm}.

For radius chain calculations the absolute tensile forces are applied [N], *[lbf].*

Straight chains

$F_S \leq F_{adm}$ [N], *[lbf]*

Radius chains

$F_{SR} = F_E \cdot c_s \leq F_{adm}$ [N], *[lbf]*

F_{adm}	=	Admissible tensile force [N], *[lbf]*
F_S	=	Adjusted tensile force (chain pull) [N], *[lbf]*
F_E	=	Effective tensile force [[N], *[lbf]*
F_{SR}	=	Absolute tensile force [N], *[lbf]*
c_s	=	Service factor (see page 45)

Select shaft type, shaft material and size. The shaft must fulfill the following conditions:

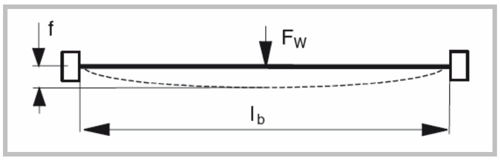
- Max. shaft deflection under full load F_W:
  f_{max} = 2.5 mm *(0.1")*.
  For more accurate approach refer to Habasit CHAIN-SeleCalc program.
  If the calculated shaft deflection exceeds this max. value, select a bigger shaft size or install an intermediate bearing on the shaft.
- Torque at max. load F_S below critical value (admissible torque, see table "Maximum admissible torque").

Shaft deflection

2 bearings: $f = 5/384 \cdot F_W \cdot l_b^3 / (E \cdot I)$ [mm], [inch]

For uni-directional head drives: $F_W = F_S$
For bi-directional center drives: $F_W = 2 \cdot F_S$

F_W = Shaft load [N], *[lbf]*
l_b = Distance between bearings [mm], *[inch]*
If the effective distance is not known use chain width + 100 mm *(4")*



E = Modulus of elasticity [N/mm²], *[lbf/inch²]*
I = Inertia [mm⁴], *[inch⁴]*

Shaft materials	Modulus of elasticity E	Admissible shearing strength τ_{adm}
Carbon steel	206'000 N/mm² *29.9 · 10⁶ psi*	60 N/mm² *8700 psi*
Stainless steel	195'000 N/mm² *28.3 · 10⁶ psi*	60 - 90 N/mm² *8700 - 13050 psi*

Shaft size		Inertia I	
mm	*inch*	mm⁴	*inch⁴*
Ø 25	*Ø 1*	19'170	*0.05*
□ 25	*□ 1*	32'550	*0.083*
Ø 40	*Ø 1.5*	125'660	*0.253*
□ 40	*□ 1.5*	213'330	*0.42*
Ø 60	*Ø 2.5*	636'170	*1.95*
□ 60	*□ 2.5*	1'080'000	*3.25*

Torque on journal (shaft end on motor side)
The torque is calculated in order to evaluate the shaft journal diameter needed for transmission. Verify the selected size of the shaft journals by comparing the effective torque T_M with the **admissible torque** T_{adm} indicated in table "Maximum admissible torque".

Effective torque: $T_M = F_S \cdot d_P/2 \cdot 10^{-3}$ [Nm]
$T_M = F_S \cdot d_P/2$ *[lbf inch]*

Admiss. torque: $T_{adm} = \tau_{adm} \cdot \pi \cdot d_W^3 / 16 \cdot 10^{-3}$ [Nm]
$T_{adm} = \tau_{adm} \cdot \pi \cdot d_W^3 / 16$ *[lbf inch]*

F_S = Adjusted tensile force [N], *[lbf]*
d_P = Pitch diameter of sprocket [mm], *[inch]*
τ_{adm} = Max. admissible shearing stress [N/mm²], *[lbf/inch²]*, see above
d_W = Shaft diameter [mm], *[inch]*

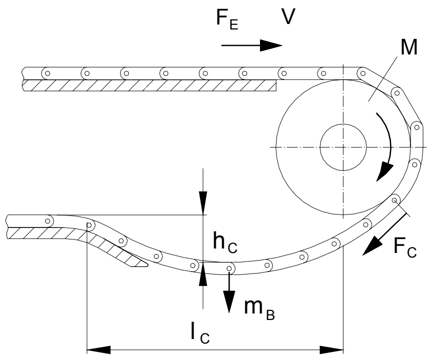
Table "Maximum admissible torque", T_{adm}

Shaft Ø (d_W)		Carbon steel		Stainless steel	
mm	*inch*	Nm	*lbf inch*	Nm	*lbf inch*
20	*0.75*	94	*834*	141	*1,251*
25	*1*	184	*1,629*	276	*2,444*
30	*1 3/16*	318	*2,815*	477	*4,223*
40	*1.5*	754	*6,673*	1'131	*10,009*
45	*1 3/4*	1'074	*9,501*	1'610	*14,251*
50	*2*	1'473	*13,033*	2'209	*19,549*
55	*2 1/4*	1'960	*17,347*	2'940	*2,6020*
60	*2.5*	2'545	*22,520*	3'817	*33,781*
80	*3*	6'032	*53,382*	9'048	*80,073*
90	*3.5*	8'588	*76,007*	12'882	*114,010*

Calculation guide
6. Calculation of the catenary sag

Catenary sag is an unsupported length of the chain for absorbing length variations caused by thermal expansion/contraction and load changes. In addition, due to its weight the sag exerts tension to the chain, which is necessary for firm engagement of the sprockets in the chain. This tension again is depending on the length l_C and height h_C of the sag.

The experience shows that the sag dimensions proposed in the chapter “Design guide - Catenary sag” provides the chain tension needed for proper engagement of the sprockets.



For chains running in cold environment (freezers etc.) additional chain length should be considered in catenary layout to compensate the chain shortening (refer also chapter “Influence of thermal expansion”).

Chain tension of catenary sag:

$F_C = (l_C^2 \cdot m_B \cdot g) / (8 \cdot h_C)$ [N], *[lbf]*

F_C	=	Chain tension of catenary sag [N], *[lbf]*
l_C	=	Length of the sag [m], *[ft]*
h_C	=	Height of the sag [m], *[ft]*
m_B	=	Weight of chain [kg/m], *[lbs/ft]*
g	=	Acceleration factor due to gravity (9.81 m/s^2, *32.2 ft/s^2*)

Calculation guide
7. Effective chain length

After the sag length l_C and height h_C have been established, it is of particular interest to calculate the excessive chain length Δl_C required by the sag (see formula below). This permits to calculate the final chain length needed.

$$\Delta l_C = 2.66 \cdot (h_C / 1000)^2 / l_C \text{ [m]}$$
$$\Delta l_C = 2.66 \cdot (h_C / 12)^2 / l_C \text{ [ft]}$$

$$l_g = 2 \cdot l_0 + d_P/1000 \cdot \pi + 2.66 \cdot (h_C / 1000)^2 / l_C \text{ [m]}$$
$$l_g = 2 \cdot l_0 + d_P/12 \cdot \pi + 2.66 \cdot (h_C / 12)^2 / l_C \text{ [ft]}$$

l_g, l_0, l_C = Length [m], *[ft]*
d_P = Pitch diameter of sprocket [mm], *[inch]*
h_C = Height of catenary sag [mm], *[inch]*

The calculated geometrical chain length (l_g) is the total chain length, which equals to the length of the transport side plus return side and sprocket circumference plus the excessive length of the catenary sag (Δl_C). The final length of the assembled chain will be somewhat longer than the calculated length, due to clearance between the pin and the bore in the link (hinge clearance). The excessive length may be around 1% of the chain length and will be corrected during installation by removing single modules.

Influence of thermal expansion
After installation the chain may be heated or cooled by the process, its length will change and consequently the height h_c of the catenary sag will change as well. The resulting chain length difference will have to be compensated within the tolerance of the sag height. The sag height should not be less than 25 mm *(1 inch)*. If the process temperature deviates from installation temperature, correct the calculated chain length as indicated by this formula.

$$l_g(T) = l_g + (l_g / 1000) \cdot \alpha \cdot (T_2 - T_1) \text{ [m]}$$
$$l_g(T) = l_g + (l_g / 12) \cdot \alpha \cdot (T_2 - T_1) \text{ [ft]}$$

l_g = Total chain length [m], *[ft]*
T_1 = Installation temperature [°C], *[°F]*
T_2 = Process temperature [°C], *[°F]*
α = Coeff. of linear thermal expansion [mm/m • °C], *[in/ft • °F]*

Chain material	Coefficient of linear thermal expansion α	
	mm/m • °C	*in/ft • °F*
Acetal (POM)	0.09	*0.00060*
Polypropylene (PP)	0.13	*0.00087*
Polybutyleneterephtalate (PET)	0.12	*0.00078*
Polyamide (PA)	0.12	*0.00078*
Polyamide reinforced	0.08	*0.00053*

Calculation guide
8. Calculation of driving power

The required power for driving a chain is the result of the friction forces in the conveyor, the change of height for elevators plus the efficiency losses (also friction) of the drive itself. The latter are not taken into account in the following formula.

Note, that the efficiency of gear and drive motor is to be considered for drive motor installation and that the drive motor should not run near 100% working load.

For efficiency of the gear and drive motor and the necessary power installed consult drive manufacturer.

$P_M = F_S \cdot v / 60$ [W]
$P_M = F_S \cdot v / 33{,}000$ *[HP]*

F_S	=	Adjusted tensile force (chain pull) [N], *[lbf]*
P_M	=	Drive output power [W], *[HP]*
v	=	Chain speed [m/min], *[ft/min]*

Material properties
Coefficient of friction

Coefficient of friction μ_G between chain and wear strip

Chain material	Lubricant	Wear strip material: Stainless steel	PE-UHMW	Lubricated cast nylon
DP	dry	0.23	0.23	0.20
	water	0.20	0.18	n.r.
	lubricant	0.14	0.11	0.10
LF	dry	0.22	0.20	0.18
	water	0.18	0.17	n.r.
	lubricant	0.13	0.10	0.10
PT	dry	0.21	0.19	0.18
	water	0.18	0.17	n.r.
	lubricant	0.13	0.10	0.10
TS	dry	0.20	0.19	0.18
	water	0.17	0.16	n.r.
	lubricant	0.12	0.10	0.10
EC	dry	0.60	0.30	0.26
	water	-	-	n.r.
	lubricant	-	-	-
AS	dry	0.23	0.23	0.20
	water	-	-	n.r.
	lubricant	-	-	0.10
PK	dry	0.28	0.25	0.30
	water	0.17	0.16	n.r.
	lubricant	0.12	0.10	0.10
WR	dry	0.30	0.25	n.r.
	water	n.r.	n.r.	n.r.
	lubricant	0.12	0.10	0.10
WK	dry	0.28	0.22	n.r.
	water	n.r.	n.r.	n.r.
	lubricant	0.12	0.10	0.10

n.r. = not recommended
\- = not measured

Chain material	Lubricant	Wear strip material: Stainless steel	PE-UHMW	Lubricated cast nylon
NY	dry	0.25	0.20	n.r.
	water	0.20	0.15	n.r.
	lubricant	0.12	0.10	0.10
HT	dry	0.25	0.20	n.r.
	water	0.20	0.15	n.r.
	lubricant	0.12	0.10	0.10
NG	dry	0.26	0.16	0.18
	water	0.18	0.15	n.r.
	lubricant	0.12	0.10	0.10
FR	dry	0.27	0.17	0.15
	water	-	-	n.r.
	lubricant	-	-	-
GR	dry	0.30	0.23	0.26
	water	0.18	0.15	n.r.
	lubricant	0.12	0.10	0.10
PP	dry	0.30	0.23	0.26
	water	0.18	0.15	n.r.
	lubricant	0.12	0.10	0.10
CR	dry	0.24	0.23	0.20
	water	0.18	0.17	n.r.
	lubricant	n.r.	n.r.	n.r.
PC	dry	0.25	0.20	0.15
	water	0.20	0.15	n.r.
	lubricant	0.15	0.10	0.10
CS	dry	0.50	0.40	0.35
	water	n.r.	n.r.	n.r.
	lubricant	0.20	0.15	0.15
SS - SH - SA	dry	0.50	0.40	0.35
	water	0.40	0.25	n.r.
	lubricant	0.20	0.15	0.15

Note
The friction values listed in the above table are based on our in-house testing standards. The actual coefficient of friction may differ depending on the particular conditions.

Material properties
Coefficient of friction

Coefficient of friction μ_P between chain and product

Chain material	Lubricant	Product material: Retur-nable glass	Alu-minum	Plastic (PET)	Card-board
DP	dry	0.19	0.18	0.14	0.25
	water	0.17	0.16	0.12	n.r.
	lubricant	0.14	0.12	0.11	n.r.
LF	dry	0.18	0.17	0.13	0.22
	water	0.16	0.15	0.11	n.r.
	lubricant	0.13	0.12	0.10	n.r.
PT	dry	0.17	0.17	0.12	0.24
	water	0.15	0.15	0.11	n.r.
	lubricant	0.12	0.12	0.10	n.r.
TS	dry	0.16	0.16	0.12	0.25
	water	0.15	0.15	0.11	n.r.
	lubricant	0.12	0.11	0.10	n.r.
EC	dry	0.30	0.30	0.20	0.25
	water	-	-	-	n.r.
	lubricant	-	-	-	n.r.
AS	dry	0.16	0.18	0.13	0.25
	water	-	-	-	n.r.
	lubricant	-	-	-	n.r.
PK	dry	0.13	0.16	0.12	0.24
	water	0.12	0.15	0.11	n.r.
	lubricant	0.10	0.12	0.10	n.r.
WR	dry	0.38	-	-	0.30
	water	n.r.	n.r.	n.r.	n.r.
	lubricant	0.16	-	-	n.r.
WK	dry	0.35	-	-	0.30
	water	n.r.	n.r.	n.r.	n.r.
	lubricant	0.15	-	-	n.r.

n.r. = not recommended
\- = not measured

Chain material	Lubricant	Product material: Retur-nable glass	Alu-minum	Plastic (PET)	Card-board
NY	dry	0.18	0.25	0.20	0.25
	water	n.r.	n.r.	n.r.	n.r.
	lubricant	0.15	0.15	0.15	n.r.
HT	dry	0.18	0.25	0.20	0.25
	water	n.r.	n.r.	n.r.	n.r.
	lubricant	0.15	0.15	0.15	n.r.
NG	dry	0.13	0.31	0.12	-
	water	0.12	0.23	0.11	n.r.
	lubricant	0.10	0.12	0.10	n.r.
FR	dry	0.21	0.27	0.18	0.26
	water	-	-	-	n.r.
	lubricant	-	-	-	n.r.
GR	dry	0.32	0.48	0.29	0.42
	water	0.25	0.27	0.22	n.r.
	lubricant	0.15	0.15	0.15	n.r.
PP	dry	0.32	0.48	0.29	0.42
	water	0.25	0.27	0.22	n.r.
	lubricant	0.15	0.15	0.15	n.r.
CR	dry	-	-	-	-
	water	-	-	-	n.r.
	lubricant	n.r.	n.r.	n.r.	n.r.
PC	dry	0.20	0.20	0.20	0.20
	water	0.15	0.18	0.18	n.r.
	lubricant	0.13	0.15	0.13	n.r.
CS	dry	0.45	0.35	0.31	0.40
	water	n.r.	n.r.	n.r.	n.r.
	lubricant	0.20	0.19	0.17	n.r.
SS - SH - SA	dry	0.40	0.33	0.30	0.40
	water	0.25	0.27	0.23	n.r.
	lubricant	0.20	0.18	0.15	n.r.

Note
The friction values listed in the above table are based on our in-house testing standards. The actual coefficient of friction may differ depending on the particular conditions.

Appendix
Trouble shooting guide

Rapid or unusual wear of the chain

Possible cause	Proposed measures
Sprocket misalignment	Correct the shaft mounting position and sprocket alignment.
Obstruction cutting or scraping the chain	Locate the origin of the cutting and remove the obstruction. Replace any wear strips that have foreign particles embedded in them.
Grooved wear strips	Remove abrasive build-up or replace wear strips with a harder material (if necessary).
Inadequate guide clearance in which guide tracks may be interfering with the chain	Make sure that there are no tight spots. Check to assure that proper guide clearances are provided. Pull a short piece of chain through the tight section before reinstallation. Check that there is a smooth transition between straight and curved sections. Also ensure that there is clearance for the tabs throughout the entire conveyor.
Chain is riding uneven in the track	Check to insure the wear strips are even and level. Modify the wear strips as required by adding or deleting shims.
Improper return roller diameter	Refer to the HabaCHAIN® Product Guide and the Product Data Sheets for the minimum back-bending radius.
Return roller has stopped spinning freely	Ensure that all return rollers are spinning freely.

Notes:
- Unusual wear patterns on the top of the chain usually indicate return way problems
- Unusual wear patterns on the bottom of the chain usually indicate transport side problems
- Excessive wear on the thrust surface of the chain usually indicates corner track or disc problems

Chemical attack
Plastic chains appear cracked or discolored (white residue is found on the chain)

Possible cause	Proposed measures
Chemical attack due to product spillage	Refer to the chapter “Chemical Resistance” of the HabaCHAIN® Product Guide.
Use of strong chemical cleaners or lubricants	Review your methods of cleaning.

Excessive sprocket wear

Possible cause	Proposed measures
Abrasive environment	Clean conveyors frequently to reduce the amount of abrasives present. Review the sprocket material options.
Incorrect “A1” and “C” dimensions	Correct the shaft mounting position and sprocket alignment.

Appendix
Trouble shooting guide

Excessive chain wear

Possible cause	Proposed measures
Abrasive material	Improve cleaning or add protectice shields to reduce the amount of abrasive material contacting the chain and sprocket.
Incorrect chain and/or wear strip material	Check material specifications to ensure that the optimal material is used. Call Habasit technical service for a recommendation.
Method of product loading	Reduce the distance that product is deposited on the chain. If product sliding occurs, refer to material specifications.
High chain speed	High chain speeds will increase the wear especially on conveyors with short centerline distances. Reduce chain speed if possible.

Premature chain elongation

Possible cause	Proposed measures
Abrasive material	Improve cleaning or add protectice shields to reduce the amount of abrasive material contacting the chain and sprocket.
Incorrect tension	Adjust.
High temperatures	High temperatures cause the chain to elongate a large percentage. Check if the catenary sag is long enough to compensate the elongation.

Broken top plates or tabs

Possible cause	Proposed measures
Obstructions in conveyor frame, product jam or improper guide clearance	Locate and remove obstruction. Check guide clearance. Replace broken links if required.
Tight corner radius	Make sure corner tracks (or discs) comply with the minimum sideflexing radius of the chain.
Chemical attack	Refer to the chapter “Chemical Resistance” of the HabaCHAIN® Product Guide.
Impact loading	Remove the source of impact loading. Consult Habasit technical service for proper chain selection for applications involving impact loading.

Chain is squealing

Possible cause	Proposed measures
Chain is trying to pass through a tight section of the conveyor	Make sure that there are no tight spots. Check to assure that proper guide clearances are provided. Pull a short piece of chain through the tight section before reinstallation. Make sure that there is a smooth transition between straight and curved sections. Also ensure that there is clearance for the tabs throughout the entire conveyor.
Improper curve radius	Make sure corner tracks (or discs) comply with the minimum sideflexing radius of the chain.
Rough surface finish on the inside corner track	Check to ensure that there is a smooth finish on the wear strips where they contact the chain (i.e. no rough saw cuts or machining marks). Replace corner tracks if necessary.
Improper corner track material selection	Check if there are foreign particles embedded in the corner tracks. Habilon or metal may provide a harder surface.
Improper corner track selection	Selective lubrication or corner discs may be required.
Vibration within conveyor frame	Make sure conveyor structure is solid.

Appendix
List of abbrevations

1. Symbols for calculations

Term	Symbol	Metric unit	Imperial unit
Coefficient of thermal expansion	α	$\frac{mm}{m \cdot °C}$	*$\frac{inch}{ft \cdot °F}$*
Coefficient of friction chain/support	μ_G	–	–
Coefficient of friction chain/product	μ_P	–	–
Chain width	b_0	mm	*inch*
Service factor	c_S	–	–
Temperature factor	c_T	–	–
Speed factor	c_V	–	–
Pitch diameter of sprocket	d_P	mm	*inch*
Shaft diameter	d_W	mm	*inch*
Modulus of elasticity	E	N/mm^2	*$lbf/inch^2$*
Shaft deflection	f	mm	*inch*
Admissible tensile force	F_{adm}	N	*lb*
Chain tension caused by the catenary sag	F_C	N	*lb*
Effective tensile force (chain pull)	F_E	N	*lb*
Nominal tensile strength	F_N	N	*lb*
Adjusted tensile force (belt pull) with service factor	F_S	N	*lb*
Shaft load	F_W	N	*lb*
Acceleration factor due to gravity	g	$9.81\ m/s^2$	*$32.2\ ft/s^2$*
Conveying height	h_0	mm	*inch*
Height of catenary sag	h_C	mm	*inch*
Inertia	I	mm^4	*$inch^4$*
Distance between conveyor shafts	l_0	m	*ft*
Conveying distance, horizontal projection	l_1	m	*ft*
Chain length with accumulated products	l_a	m	*ft*
Distance between bearings	l_b	mm	*inch*
Length of catenary sag	l_C	mm	*inch*
Total geometrical chain length	l_g	mm	*inch*
Mass of chain / m (chain weight / m)	m_B	kg/m	*lb/ft*
Mass of product / m (product weight / m)	m_P	kg/m	*lb/ft*
Chain pitch	p	mm	*inch*
Power, motor output	P_M	kW	*HP*
Operation temperature	T	°C	*°F*
Torque of motor	T_M	Nm	*in-lb*
Chain speed	v	m/s	*ft/min*

Appendix
List of abbrevations

2. Symbols for illustrations

Term	Symbol	Metric value	Imperial value
Level (height) of wear strip in respect to the shaft center	A_1	mm	*inch*
Keyway width	b	mm	*inch*
Distance between end of wear strip and sprocket shaft center	C	mm	*inch*
Catenary sag	CA	–	–
Shaft diameter	Ød	mm	*inch*
Pitch diameter of sprocket	$Ød_p$	mm	*inch*
Distance pin center plane – top plate backside	E	mm	*inch*
Distance pin center plane – wear strip	F	mm	*inch*
Keyway height	h	mm	*inch*
Motor / drive shaft	M	–	–
Product base diameter	Pb	mm	*inch*
Roller	R_1, R_2	–	–
Chain support return side	SR	–	–
Wear strip transport side	ST	–	–
Overall height shaft + keyway	t	mm	*inch*
Take-up device (tensioning device)	TU	–	–
Idling shaft	U	–	–

Appendix
Conversion of units metric / imperial

Metric units		**multiply by...>**	**for imperial units**		**multiply by...>**	**for metric units**	
Length							
mm	(millimeter)	0.0394	*inch*	*(inch)*	25.4	mm	(millimeter)
m	(meter)	3.281	*ft*	*(foot)*	0.3048	m	(meter)
Area							
mm^2	(square-mm)	0.00155	*$inch^2$*	*(square-inch)*	645.2	mm^2	(square-mm)
m^2	(square-m)	10.764	*ft^2*	*(square-foot)*	0.0929	m^2	(square-m)
Speed							
m/min	(meter/min)	3.281	*ft/min*	*(foot/min)*	0.3048	m/min	(meter/min)
Mass							
kg	(kilogram)	2.205	*lb*	*(pound-weight)*	0.4536	kg	(kilogram)
Force							
N	(Newton)	0.225	*lbf*	*(pound-force)*	4.448	N	(Newton)
Strength							
N/mm^2	(Newton/sq-mm)	145	*psi = $lbf/inch^2$*	*(pound-force/ square-inch)*	$6.89 \cdot 10^{-3}$	N/mm^2	(Newton/sq-mm)
Power							
kW	(kilowatt)	1.341	*hp*	*(horsepower)*	0.7457	kW	(kilowatt)
Torque							
Nm	(Newton-meter)	8.85	*in-lb*	*(inch-pound)*	0.113	Nm	(Newton-meter)
Temperature							
°C	(Celsius)	9 · (°C / 5)+32°	*°F*	*(Fahrenheit)*	5/9 · (°F-32°)	°C	(Celsius)

Appendix
Glossary of terms

Term	Explanation	Habasit symbol
Accumulation conveyor	Conveyor that collects temporary product overflows.	
Accumulation length (distance)	Distance of product accumulation in running direction of the chain.	**l_a**
Acetal	Polyoxymethylen (POM)	**POM**
Adjusted tensile force (adjusted chain pull)	Applies a service factor to adjust the effective tensile force calculated near the driving sprocket, taking into account possible inclines and frequent start/stops.	**F_S**
Admissible tensile force	Force or chain pull allowed near the driving sprocket under process conditions (temperature, speed).	**F_{adm}**
Transport length	Conveying length measured between the centers of driving and idling shafts.	**l_0**
Back-bending	Negative bending of the chain (opposite of chain bending over sprocket)	
Chain length, inclined	Conveying length measured as vertical projection of distance between the centers of driving and idling shafts.	**l_1**
Chain length (theoretical)	Length of chain measured around the sprockets including additional length of catenary sag.	**l_g**
Chain pitch (module pitch)	Center distance between the pivot pins (hinges) of a chain module.	**p**
Chain width	Geometrical width of the top plate of the chain.	**b_0**
Bi-directional drive	Driving concept allowing to run the chain forward and backward.	
Carry way	Transport side of the chain, carrying the product.	**ST, SR**
Catenary sag	Unsupported length of the chain for absorbing chain length variations due to thermal expansion and load changes of chain.	**CA**
Central drive concept	Motor located on the return way of the chain in-between of the conveyor (for bi-directional drive).	
Chordal action	Polygon effect: Pulsation of the chain velocity caused by the polygon shape of the driving sprocket, with rise and fall of the chain surface.	
Coefficient of friction	Ratio of frictional force and contact force acting between two material surfaces.	**μ_G, μ_P**
Coefficient of thermal expansion	Ratio of chain lengthening and the product of chain length and temperature change.	**α**
Dead plate	Metal or plastic plate installed between meeting conveyors as transfer bridge.	
Effective tensile force (effective chain pull)	Calculated near the driving sprocket, where it reaches in most cases its maximum value during operation. It depends on the friction forces between the chain and the slider supports (ST) and (SR) as well as friction against accumulated load.	**F_E**
Elevating conveyor	Conveyors transporting the products to a higher or lower level, using flights or other suitable means to keep the products in place.	
Flight	Chain module with molded vertical plate for elevating conveyors. The flights prevent the product from slipping back while being moved upwards.	
Idler	Shaft and sprocket at the chain end opposite to the driving shaft. It is normally equipped with a freewheeling sprocket or idler.	
Mass of chain (chain weight per length)	The chain mass (weight) is added to the product mass per [m] or [ft] for calculation of the friction force between chain and wear strip.	**m_B**
Mass of product (product weight per	Conveyed product weight as expected to be distributed over the chain length; calculated average load in [kg/m], *[lb/ft]*.	**m_P**

Appendix
Glossary of terms

Term	Explanation	Habasit symbol
length)		
Nominal tensile strength	Catalogue value. It reflects the maximum allowable chain pull at room temperature and very low speed.	F_N
Pitch diameter	Diameter of the sprocket which defines the position of the pins of the driven chain.	**Ødp**
Polygon effect	Chordal action: Pulsation of the chain velocity caused by the polygon shape of the driving sprocket, with rise and fall of the chain surface.	
Radius chain	Chain suitable for running around curves (radius applications).	
Screw type take-up	The catenary sag is adjusted by means of a screw tensioning device at the idling shaft of the conveyor.	
Service factor	The calculated effective chain pull is adjusted with the service factor taking into account possible heavy running conditions (start/stop, inclination).	c_S
Slat Top chain	The top plate of the chain is flat and closed (no openings, no flights).	
Slider support	Frame equipped with wear strips to carry the running chain with low friction and wear.	**ST, SR**
Speed factor	*The nominal tensile force*, valid at very low speed and room temperature, is reduced to the admissible tensile force by the influence of higher speed and/or temperature; therefore it is multiplied with the respective factor.	c_V
Sprocket	Gear, mostly plastic, in exceptional cases made of metal, shaped to engage the chain, providing positive torque transmission to the chain.	
Tab	"Hook" shaped tabs on the bottom of the radius chain, running below a guide rail. Prevent the chain from lifting of the base in the curve.	
Take-up	Tensioning device for adjustment of the catenary sag, screw type, gravity type or spring loaded type at the idling shaft of the conveyor	**TU**
Temperature factor	*The nominal tensile force*, valid at very low speed and room temperature, is reduced to the admissible tensile force by the influence of higher speed and/or temperature; therefore it is multiplied with the respective factor.	c_T
Transport side	Carry way of the chain, carrying the product.	
Wear strip	Sliding strip, mainly made of plastic, used on the conveyor frame to provide low friction and low wear.	

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